A Scranton Gillette Publication

MARCH 1959

WATER & SEWAGE WORKS

WATER SUPPLY SEWAGE DISPOSAL

UNIVERSITY MICROFILMS
313 N. 1ST ST.
ANN ARBOR, MICH.
COMP

Research is the Stairway to ater Resources of the Future

Entrance to Water Resources Building of Illinois State Water Survey, Urbana, Ill.

See page 99 for review of 50 years of research

A VOTING MACHINE UNLEASHES AN ADDED 300 MILLION GALLONS OF WATER DAILY!

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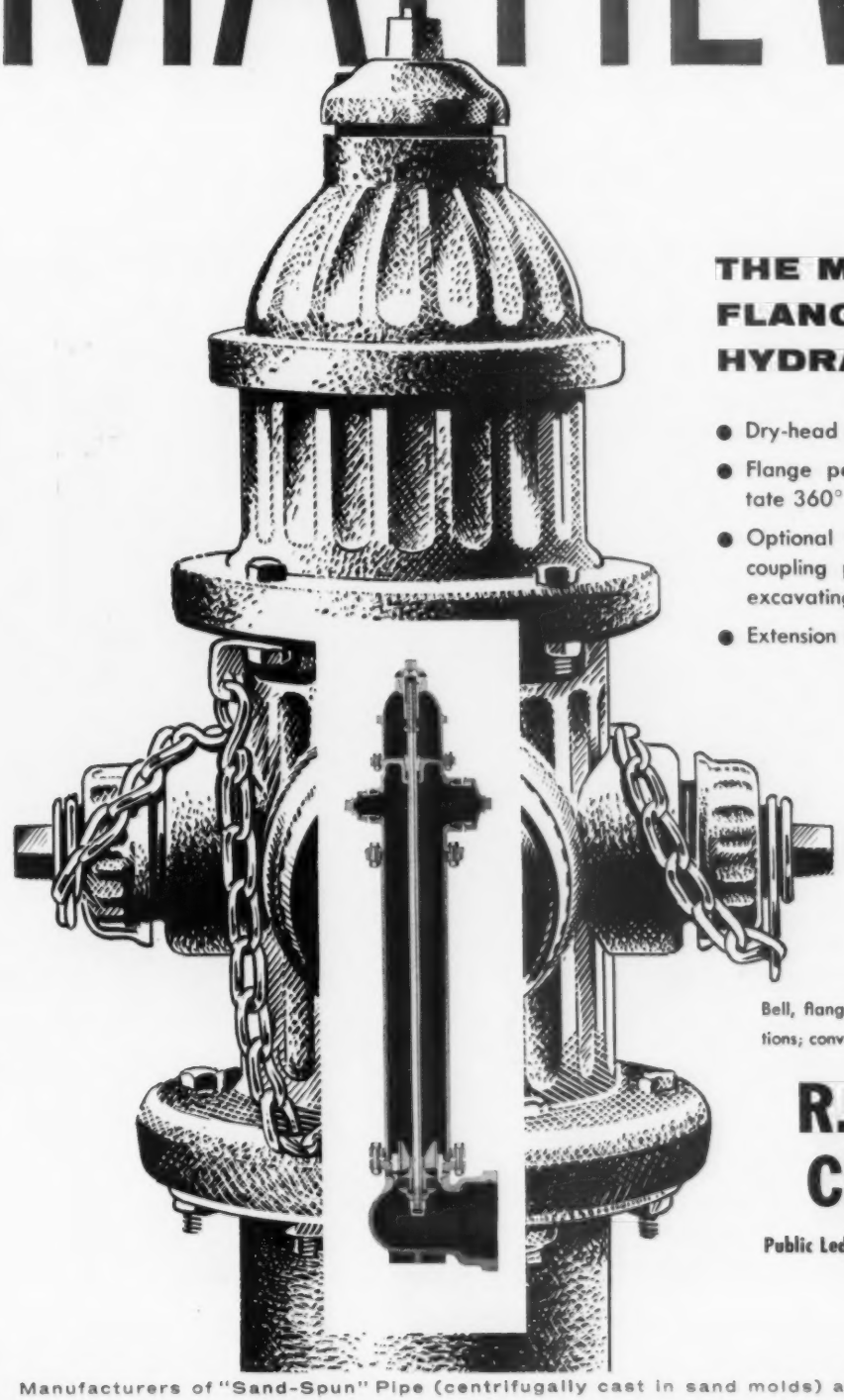
MATHEWS



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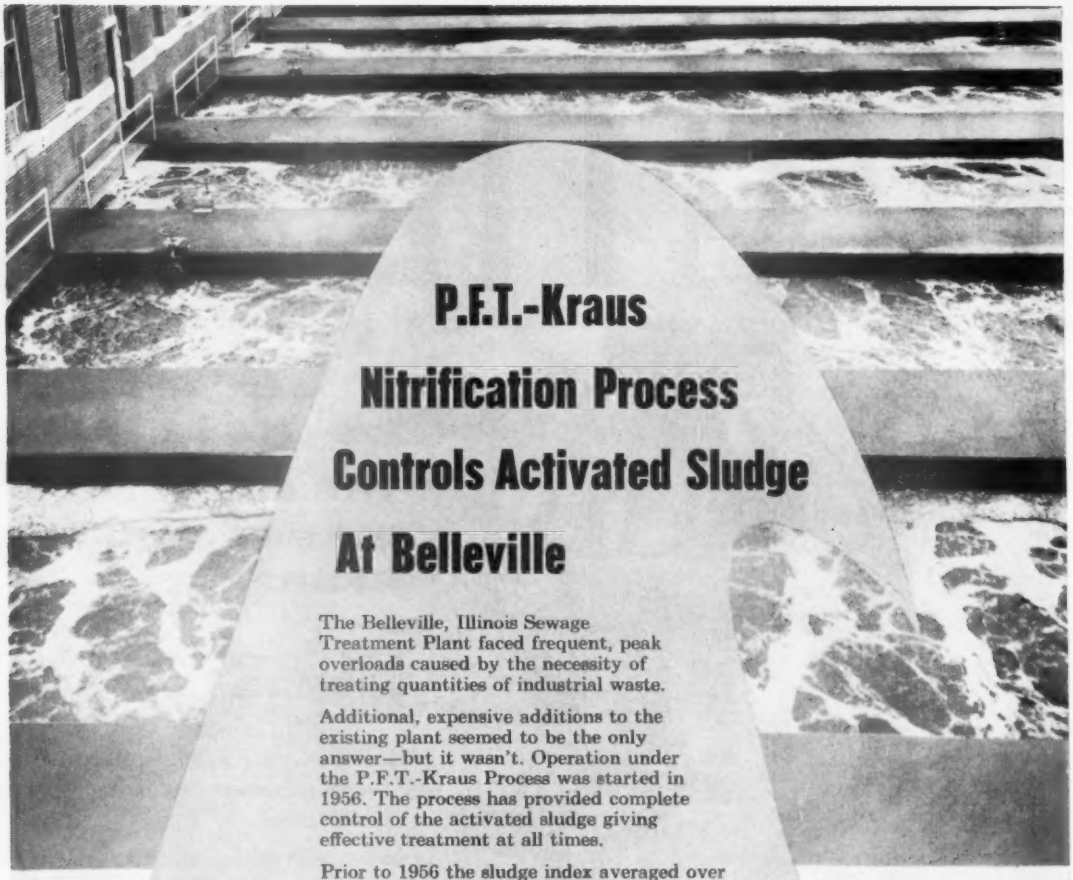

P.F.T.-Kraus Nitrification Process Controls Activated Sludge At Belleville

The Belleville, Illinois Sewage Treatment Plant faced frequent, peak overloads caused by the necessity of treating quantities of industrial waste.

Additional, expensive additions to the existing plant seemed to be the only answer—but it wasn't. Operation under the P.F.T.-Kraus Process was started in 1956. The process has provided complete control of the activated sludge giving effective treatment at all times.

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Plant operating personnel estimate that the present plant facilities will be capable of handling an increase of 20,000 population loading—by readily supplying more effective aeration with the P.F.T. Dual Aeration System.

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waste treatment equipment exclusively since 1893

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Vol. 106 No. 3

MARCH • 1959

A Scranton Gillette Publication

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Published and Copyrighted 1959 by Scranton Publishing Co., Inc.

WATER & SEWAGE WORKS is published monthly with an extra issue in August. Subscriptions including the Reference Number issue in the U.S. and Canada, 1 year $5.00; 2 years $7.50; 3 years $10.00. Other countries $1.50 per year additional. Single copies 50c except Reference Number $1.00.

E. Scranton Gillette, President; George E. Symons, Executive Vice President; C. T. Gillette, Secretary; and H. J. Conway, Treasurer; M. B. Nylund, Vice Pres.

WATER & SEWAGE WORKS, Reg. U.S. Patent Off. Published monthly by Scranton Publishing Co., Inc., at 1600 N. Main St., Pontiac, Ill. Entered as second class matter at the post office at Pontiac, Ill., under Act of March 3, 1879.

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improved... streamlined... modernized...the

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has ALL these features...

★ *Optional ground line break flange*
★ *Large diameter barrel for increased flow*
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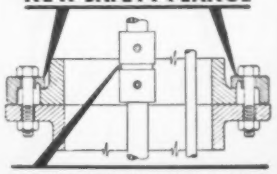

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WATERFORD NEW YORK

Briefs

The 1958 Annual Index for WATER & SEWAGE WORKS is now available. If you wish a copy, write to our editorial office at 155 E. 44th St., New York 17, N. Y.

The Illinois State Water Survey has been in existence since 1895, and has contributed greatly to the fund of general and specific knowledge in the field of sanitary engineering as well as serving the people of the state of Illinois. A review of the past 50 years of research and study coincides with the 50th Anniversary of the founding of the Illinois Section of AWWA. Operation and cooperation of the Section and the Water Survey have coincided in many areas of effort—page 99.

Water Works Management was the subject of a short school held by the University of Illinois under the sponsorship of the Illinois Section AWWA. Part I of that report appeared last month; Part II appears on page 104.

Current Events in Water Works Law, Part II, covers liability for main breaks, rusty water damages, service extensions, Federal government and outside rate systems—page 107.

Centrifugal Pumps require proper selection and installation; they have many applications. In the field of water and sewage treatment the centrifugal pump with gravity feed and properly designed discharge line is a dependable and flexible unit and operates at a reasonable cost—page 110.

Water Works Management—Symposium—Part I presents three of nine papers on this general theme. These three articles cover "A Management Philosophy," "What is a Manager" and "The Water Works Survey"—page 115.

Sanitary Sewer Extensions are a problem to many municipalities, sanitary authorities, or sanitary districts. In the population trend to ex-urban or semi-rural living, the construction of sanitary sewerage systems often becomes a financial burden to the city taxpayers or long time consumers. Three Texas cities report on their policy for sanitary sewer extensions—page 123.

Instrumentation and Control in waste treatment becomes more and more important as modern practice in sewage and waste treatment progresses toward more complete automation. This article reviews various applications of instrumentation and control as well as types of devices and where they are used—page 126.

Units Underground are part of the design of the Bondi Outfall Treatment Works at Sidney, Australia—page 132.

Industrial Wastes in municipal plants may cause various problems in sewage treatment operations. Part II of this article appears on page 136.

ORSANCO'S 10th Annual Report shows appreciable gains in reducing the pollution load on the Ohio River. This two page abstract highlights these gains—page 140.

THE EDITOR'S COMMENTS deal with water resources, water works management, and the population boom—page 142.

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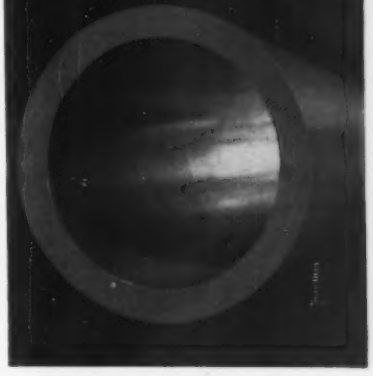
cut corrosion costs with Byers PVC Pipe



Since PVC is a non-conductor, it is immune to galvanic or electrolytic attack. Smooth, inside and out. Does not pit, groove or tuberculate. Attacked by relatively few chemicals. Completely amorphous. Ageless. No oxidation. Immune to oxidants such as nitric acid, sodium hypochlorite, bleaches.

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ALLIS-CHALMERS ACQUIRES S. MORGAN SMITH ...FORMS NEW HYDRAULIC DIVISION

On February 1, the S. Morgan Smith Company became a part of Allis-Chalmers. Extensive A-C facilities in Milwaukee, together with two S. Morgan Smith plants in York, Pennsylvania, are now operating as the newly created Allis-Chalmers Hydraulic Division.

In acquiring S. Morgan Smith, A-C combines its own broad background in hydraulics with the 80 years of diversified engineering and manufacturing knowledge of SMS.

The York facilities will be devoted to the continued research, design, engineering and fabrication of a complete line of hydraulic turbines and accessories, pumps and pump-turbines, valves for industrial, waterworks and power applications, and specialized heavy equipment.

Product information or engineering help can be obtained from your nearby Allis-Chalmers office, or by writing Allis-Chalmers, Hydraulic Division, York, Pennsylvania.

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News—Here & There

"Mr. Water Works" Retires

Ray Faust to succeed Harry Jordan as Secretary AWWA

RAYMOND J. FAUST receives congratulations from HARRY JORDAN after his appointment as Secretary. Looking on are Lewis S. Finch, President, and Lauren W. Grayson, Vice President of the AWWA.

Harry E. Jordan has announced his retirement, as of September 1st, after serving nearly 23 years as secretary of the American Water Works Association.

Mr. Jordan, who this fall will round out 56 years service in the water utility field, made his retirement plans known at the annual meeting of the association's board of directors, held in January. The directors named Raymond J. Faust, executive assistant secretary since February 1, 1951, to succeed Mr. Jordan upon his retirement.

Harry Jordan, affectionately known as "Mr. Water Works", took over as the association's first fulltime secretary in December, 1936, when the organization had only 3,000 members.

Born in Coulterville, Ill., November 15, 1882, Mr. Jordan spent his boyhood days in Franklin, Ind. He was graduated with a B.S. degree in chemical engineering from Franklin (Ind.) College in 1903, and this educational institution awarded him an honorary degree of Doctor of Science in 1938. He entered the water works industry immediately after graduation in 1903 as a chemist with the Indianapolis Water Co., leaving the post of superintendent of purification after 33 years with the company to take the New York post.

Mr. Jordan served in many capacities in AWWA including chairmanship of the Indiana Section, Member of the board from Indiana and as president of the Association in 1934-35. He is an honorary member of the AWWA, a life member of the ACS, an affiliate (life) member of the ASCE, a fellow (life) member of the APHA, and an honorary member of the Institution of Water Engineers of Great Britain. Mr. and Mrs. Jordan observed their fiftieth wedding anniversary on September 12, 1957, and live in Port Washington, L. I., N. Y.

Mr. Faust, who will succeed Mr. Jordan as chief administrator of the association, was born in Millersburg, Pa., and was graduated from Penn State University with a B.S. degree in sanitary engineering in 1923. He was awarded a C.E. degree in 1935.

Mr. Faust's first job after graduation was as an engineer in the water supply section of the Michigan Dept. of Health in Lansing, Mich. He spent 28 years in this department and was chief of the water supply section when he resigned to join the association staff in New York. He served as secretary of the Michigan AWWA Section and was a member of the association's board of directors in 1950-51.

Atlanta Upgrades Nixon

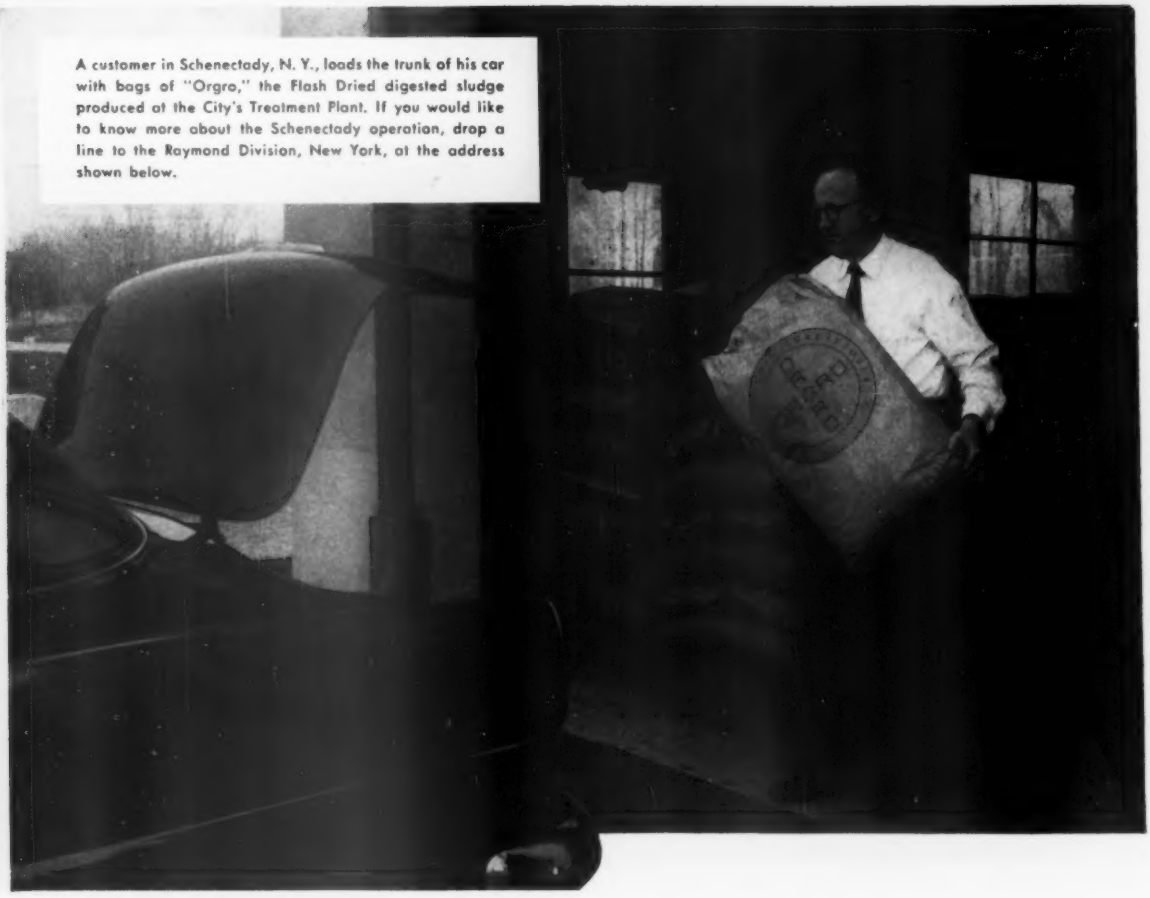
M. B. Nixon, for the past 15 years Engineer in charge of sewers for the City of Atlanta, Ga., has recently been promoted to the position of Assistant Chief of Construction.

In his new post, Mr. Nixon will assist in the administration of the Construction Department of the City which has charge of engineering, construction and maintenance of bridges, sewers, sewage treatment plants, streets and highways. He will continue to devote most of his time to sewer and sewage treatment problems and will supervise planning and construction of improvements and enlargement of the sewer system and treatment plants now getting under way which will involve an expenditure of $11 million over the next three years.

Puerto Rico Authority Revenues Increase

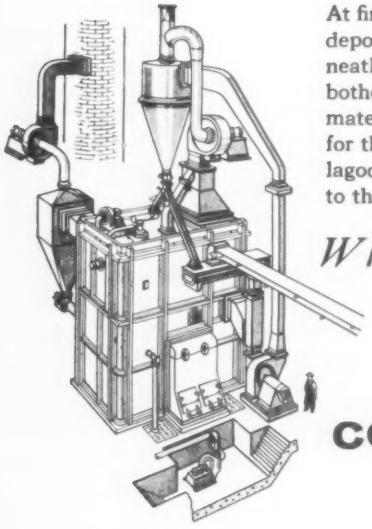
Revenues of the Puerto Rico Aqueduct and Sewer Authority during the month of November, 1958 totaled $688,757, compared with $651,459 in November of 1957, according to Rafael V. Urrutia, Executive Director of the Authority.

During the month of November the Authority completed 14 projects and 18 new ones were begun.



A customer in Schenectady, N. Y., loads the trunk of his car with bags of "Orgro," the Flash Dried digested sludge produced at the City's Treatment Plant. If you would like to know more about the Schenectady operation, drop a line to the Raymond Division, New York, at the address shown below.

Can you think of a better way to dispose of sewage sludge?



At first glance, the trunk of a car may seem to be a peculiar place to deposit sewage sludge. But when the sludge is dry, sterile and neatly packaged, it can be a marketable commodity rather than a bothersome waste. When uncontaminated with noxious industrial materials, it is an excellent soil conditioner. Its sale produces revenue for the treatment plant, eliminates the nuisances of drying beds, lagoons and ash disposal and, at the same time, renders a service to the people of the community.

What's the best method of drying sludge?

It's the C-E Raymond Flash Drying System, a system used by communities large and small across the nation, a system proved in service and one which dries more filter cake than all other systems combined.

COMBUSTION ENGINEERING

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RAYMOND DIVISION, 1315 North Branch Street, Chicago 22, Illinois
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ALSO FLASH DRYING AND INCINERATION SYSTEMS FOR INDUSTRIAL WASTE DISPOSAL

News—Here & There

CONTINUED FROM PAGE 7A

Chicago Filtration Plant Wins Architectural Award

The Chicago Central District Filtration Plant, designed by Neass & Murphy, has won the top "Industry Category, Design Award" in the 6th annual Design Awards Program sponsored by Progressive Architecture.

Of the more than 570 entries submitted in the competition by architectural firms throughout the United States, four, including the filtration plant, received the top "Design Award".

Described by the judges as "a great step forward in the design of this type of public service structure" the plant will consist of four major buildings. Two filter buildings, roofed by a series of concrete shells, will be separated by the Chemical and Administration Building and the Pump Building.

The function of the plant including the water filtration process was designed and engineered under the supervision of Commissioner George L. DeMent of the Department of Public Works and Dick Van Gorp, Chief Engineer of the Bureau of Engineering in cooperation with the Bureau of Water.

Clean-Streams Report

Cleaner streams and the development of robot monitors to maintain a continuous check on their cleanliness are forecast in the annual report of the Ohio River Valley Water Sanitation Commission.

In presenting the report, Dr. Russell E. Teague, chairman and state health commissioner of Kentucky, said: "When our regional crusade for clean streams was inaugurated ten years ago, less than 4 people out of ten in the Ohio Valley were served by sewer-purification facilities. Today the ratio is aproaching 8 out of ten."

With regard to industrial-waste discharges into streams, the report shows that ¾ of the plants in the Ohio Valley are operating facilities to curb pollution. The number now rated as having adequate control facilities is double that of 5 years ago.

Copies of the report may be had by addressing Commission headquarters, 414 Walnut Street, Cincinnati 2, Ohio.

"Dave" Purdie Dies

David J. (Dave) Purdie, long time New York sales representative of B-I-F Industries, Inc., died suddenly early this year. He had retired from active service in 1953 after 47 years with the company.

A native of Connecticut, Dave graduated from Brown University with a BS in Mechanical Engineering in 1911. He immediately joined Builders Iron Foundry for training in their shops. In 1912 he became a salesman and in 1914 Assistant District Manager in the New York office. In 1916 he became District Manager of the New York office, a position he held until 1955 when he became a Consultant to the company.

Municipal Sewage Needs Summary

The United States Public Health Service, has available a booklet compiled by John R. Thoman, Senior Sanitary Engineer and Kenneth H. Jenkins, Analytical Statistician, that presents a general summary of data relating to sewer systems and sewage disposal in the United States. This summarization, titled "Municipal Sewage Treatment Needs", of physical facilities data was based on the 1957 Inventory of Sewage and Industrial Waste Facilities. The Inventory also contained information on reported needs both for present treatment plants and for systems discharging raw sewage. This report presents summarized information on these sewage disposal requirements.

The report consists of 9 tables and explanatory text. It is available from the Superintendent of Documents, U. S. Goverment Printing Office, Washington 25, D. C. Price 15 cents.

W&SW Manufacturers Appoint PR Counsel

The Water and Sewage Works Manufacturers Association, Inc., has announced that the J. Walter Thompson Company has been appointed as Public Relations Counsel for the Association.

The selection was made after extensive research, study and discussion. The Public Relations Committee is hopeful that the program outlined by the new counsel will show results in a reasonable time.

The J. Walter Thompson Company, is one of the nation's leading advertising and public relations agencies. It presently serves some of the country's outstanding business firms and trade associations.

Water Works Safety Conferences

The University of Illinois Department of Civil Engineering and the Division of Sanitary Engineering of the State Department of Public Health have jointly started a series of annual Sanitary Engineering Conferences.

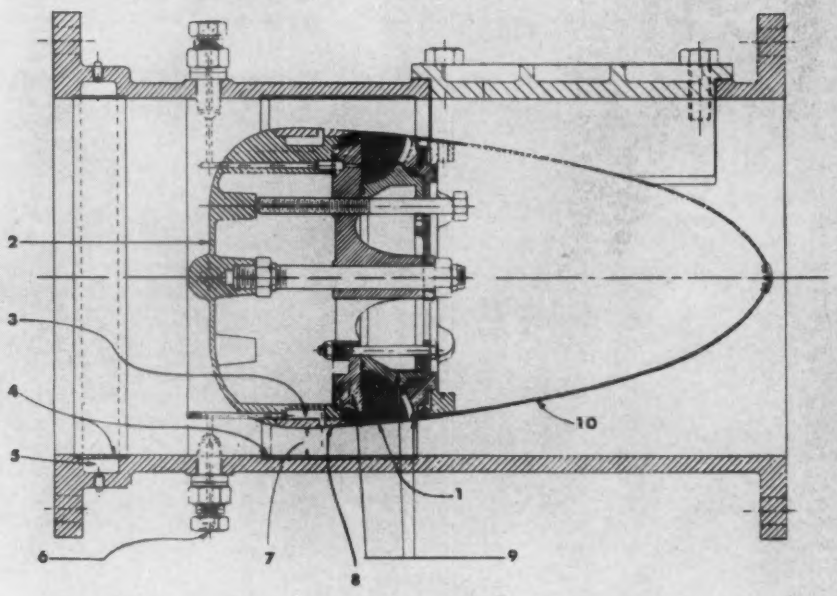
The first of this series, a conference on Water Works Safety was the subject of the first conference held at the University on January 28 and 29, 1959.

Water Quality Report

The staff of the Water Quality Division, Dept. of Public Health, State of Georgia, has available its annual report on the water quality management program in Georgia for 1958.

The report is a brief review of the cooperative program between the local governments and industrial organizations with an agency of the state government. This statewide cooperative program has as its aims the providing of the necessary water and sewage facilities commensurate with rapid population growth and industrial expansion and maintaining generally satisfactory stream quality conditions throughout the state, for the benefit of its citizens.

Continued on page 11A



1. Only moving part is this modulator.
2. Nose piece.
3. Multi-piezometer low-pressure chamber.
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8. Throat ring.
9. Modulair assembly—clamping ring, spacer, and holding ring.
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Maintenance is nil

because only one part moves in the new Modulair Flow Controller

Take the moving parts out of a rate-of-flow controller and you've taken away practically all your maintenance—and that's just what you can do with this new Simplex Modulair Flow Controller.

The only moving part inside your pipeline is a non-corroding rubber throttle.

There are no line valves, no pilot valves, no pistons or valve shafts. Not even a stuffing box to pack.

Installs like a piece of pipe. You can install a Modulair in about the time it takes to plumb a piece of pipe. It comes as a completed unit.

New bulletin. Bulletin WS-39 explains the Modulair design in greater detail and shows pictures of installations where Modulair has been in actual filter plant operation for over seven years.

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News—Here & There CONTINUED FROM PAGE 9A

PHS Approves 4 Coagulant Aids

The Public Health Service's Technical Advisory Committee on Coagulant Aids for Water Treatment has announced four more coagulant aids that meet the committee's requirements.

The manufacturer, product name, and maximum concentration recommended by the manufacturer in ppm, or the commercial aids considered are: The Burtonite Co., Burtonite #78-5; Hagan Chemicals & Controls, Inc., Coagulant Aid #2-1; and the Kelco Company, for Kelgin W and Kelcosol-2.

The committee concluded that these products can be used for the treatment of public water supplies with no adverse physiological effects upon water consumers when used in concentrations recommended by the manufacturer, and provided that they continue to meet the quality specifications furnished the committee.

The committee further emphasized that its findings bear only on the health aspects of these products and do not constitute endorsement or indicate effectiveness in purposed use.

Water Works Mule Retired Now Up for Auction

The following is a notice of public auction recently circulated by E. A. (Sig) Sigworth, Industrial Chemical Sales Div., West Virginia Pulp & Paper Co.

Notice of Public Auction

For Sale—1 Mule, Description Below
Place—Murphy's Mule Barn
Time—Any Time Now

Be it known herewith that E. A. Sigworth offers, to the highest bidder, the stubbornest mule south of the Mason-Dixon line. Said mule is a charter member, in good standing, of Murphy's Mule Barn, Inc., and is registered in the archives as Marsden C. Smith. On occasion, when he is less stubborn than usual, he will answer to the names Smitty or Marsden. Beware of calling him "Mr. Smith", because he has a very vicious kick. Never crosses a bridge, he just sits down at the table.

In recognition of many years of conscientious service, and of course with good humanitarium instincts, Smitty's employer decided to retire him to pasture on December 12, 1958. We wouldn't go so far as to say he's ornery, but why else would he select this particular day to get sick? He was immediately rushed to a hospital, and the veterinarian has given his assurance that said Mule should be able to return to normal activity within about six weeks time. Upon release from the hospital he will be returned to his stall at 312 N. Granby Street, Richmond 20, Virginia.

In view of the favorable medical report it is expected that bids will be quite high so be governed accordingly. To be acceptable, all bids must be postmarked at exactly 12:00 Noon on February 29, 1959 and mailed to General Headquarters, Murphy's Mule Barn, Inc.

In witness whereof, and as the stubbornest mule *north* of the Mason-Dixon line, I hereby affix my Signature.

P. S.—What am I offered?

Dr. Lamb Named San. Engr. for American Cyanamid

Dr. J. C. Lamb, III, has been named sanitary engineer for the Organic Chemicals Div., American Cyanamid Co.

Dr. Lamb has been with Cyanamid since 1955 when he joined the Bound Brook plant as its sanitary engineer. The plant's new $4,500,000 waste treatment plant, opened last year, was erected under his supervision.

A native of Virginia, Dr. Lamb is a graduate of Virginia Military Institute and of the Massachusetts Institute of Technology. He served on the faculty of V.M.I. from 1948 to 1950, when he joined the research and teaching staff at M.I.T. He has served as a consultant on waste treatment problems to various industries. He is now serving as chairman of the Industrial Wastes Committee of the New Jersey Sewage and Industrial Wastes Association. He is also an adjunct professor at the Newark College of Engineering.

Underground Corrosion Short Course

West Virginia University has announced the program for the 1959 short course, which will be held June 2, 3, and 4, 1959. The present program calls for 64 classes and field demonstrations. The course will cover basic, intermediate and advanced education on:

1. Fundamentals of underground metallic corrosion and corrosion control practices as related to underground pipe and cable systems. This phase covers 32 one and ½ hour classes.
2. Water—Internal and external corrosion of metallic water systems and corrosion control measures. 8—Classes.
3. Coatings—Corrosion control materials and material control practices. 8—classes.
4. Special—Instrumentation, materials and test procedures. 16—classes.

PASB Appoints Shipman Sanitation Chief

Sanitary Engineer Harold R. Shipman has recently been appointed Chief of the Pan American Sanitary Bureau's Branch of Environmental Sanitation. In his new post, Engineer Shipman will be in charge of the PASB's environmental sanitation program in the western hemisphere.

He will maintain his office at the Bureau's headquarters in Washington, D. C.

The PASB is the Regional Office for the Americas of the World Health Organization.

Engineer Shipman holds a BS degree in Chemical Engineering and Bacteriology and an MS degree in Sanitary Engineering from the University of Minnesota. Prior to joining WHO's international staff in 1952, he worked as a sanitary engineer with the Minnesota Department of Health, the Farm Security Administration and the American Red Cross in Korea. Since joining WHO he has worked in Egypt, Turkey and Austria, as well as in the region of the Americas.

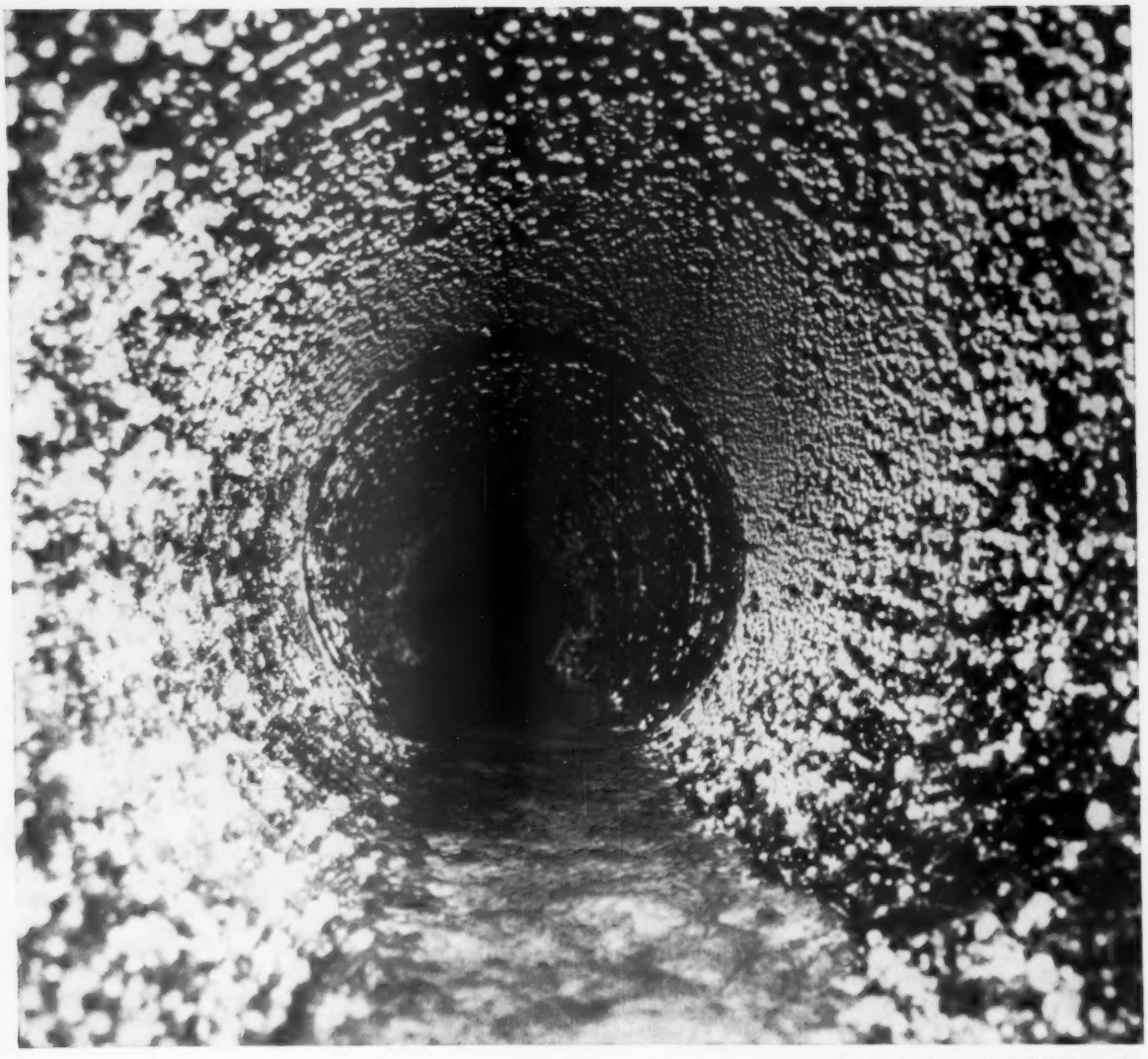


Photo courtesy National Water Main Cleaning Co.

Tuberculation did this . . .

IN JUST EIGHT MONTHS

Eight months before this picture was taken, this main was cleaned, right down to the bare metal. The photograph shows how rapidly tuberculation accomplishes its clogging, flow-reducing work.

This is where Calgon® can help. Threshold Treatment with Calgon* controls corrosion of all types by coating metal surfaces with a tough, water-excluding film. Calgon treatment is particularly effective during and after mechanical main cleaning because of its fast film-forming ability. Protection for freshly scored metal surfaces is quickly built up and easily maintained.

Calgon treatment is inexpensive as well as effective—a few ppm control tuberculation and other corrosion problems as well. A letter or phone call will bring you more information on how Calgon can help. Or, a Calgon engineer, experienced in controlling water problems of all kinds, will be glad to make detailed recommendations on your specific problem.

*Fully licensed under U.S. Patent No. 2,337,856

CALGON COMPANY
DIVISION OF **HAGAN** CHEMICALS & CONTROLS, INC.
HAGAN BUILDING, PITTSBURGH 30, PA.
In Canada: Hagan Corporation (Canada) Limited, Toronto

Equipment News

Leased Treatment Equipment

301

Infilco Inc., Tucson, Ariz., has announced a comprehensive plan for leasing water, sewage and waste treating equipment, with option to purchase. The plan can be applied to many types and sizes of equipment.

Tax deductions become an advantage in the case of industrial customers. Payments out of revenue or other sources of funds where this is practical, rather than by bond issue, can be advantageous to municipalities and other public operations.

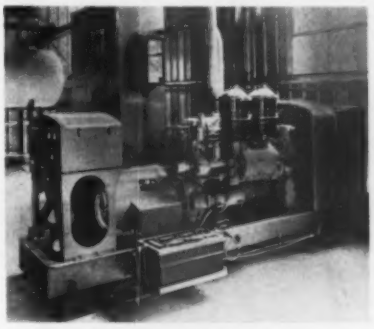
For information use Reader Service Card.

Diesel Power for Standby Generators

302

Detroit Diesel Engine Div., General Motors Corp., Detroit, Mich., has announced the addition of eight new "V" and 'in-line" engines to its line of two cycle diesels, which expands the usefulness of GM diesel power in the standby generator field.

Combined with previously existing Series 71 and 110 units, the new engines complete the world's first "All-purpose power line" consisting of 19 single and multiple units ranging from 20 to 1650 HP in only three cylinder sizes.



The expanded line is capable of driving generators producing all the way from 15 to 700 KW. Another advantage of diesel engines is the fact that the fuel on which these units run can be kept indoors in most states thereby eliminating the need for extended fuel lines.

Low Cost Sewage Sludge Incineration System

303

Standard Steel Corp., Los Angeles, Calif., has announced the development of a new, low-cost and compact Sewage Sludge Incineration System especially designed for small and medium size communities, and for industries producing sludge-like combustible wastes. The system has been developed in conjunction with the Equipment Development Company of Montclair, New Jersey.

The Standard system allows the use of an "abbreviated" sewage treatment process by offering a convenient means of rendering the sludge solids harmless by reduction to an inert ash and elimination of the need for sludge digestion.

In this system the fibrous, partially digested sludge first goes to a Roto-Plug dewatering device (no expensive conditioning chemicals are required in this step). The resulting dewatered sludge then is transported to the Standard Incineration System

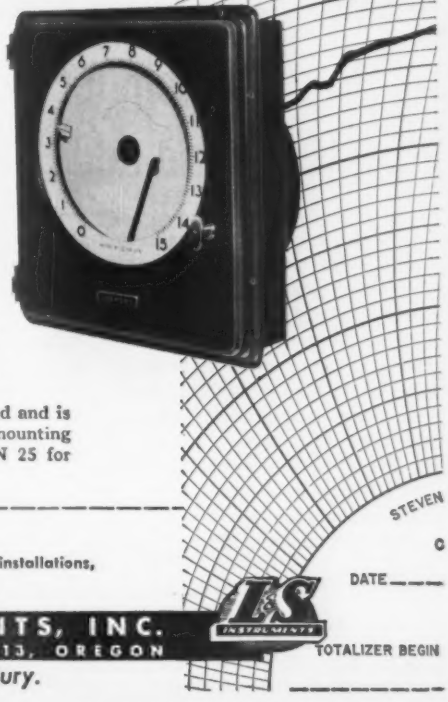
CONTINUED ON PAGE 15A

ACCURATE GRAPHIC AND VISUAL REGISTRATION

of liquid flow with

STEVENS

RECORDER TYPE B-FT



Recording, indicating and totalizing meter for measuring sewage or other flows over Parshall flumes and weirs. This instrument has interchangeable flow cams and flow conversion gears... an important factor to consider for sewage treatment plants in rapidly growing communities. With a simple change of cams and gears the Type B-FT Recorder can operate with a different size flume or accommodate a greater range of flow than that for which it was originally purchased. The change does not require factory service. Similarly, change from weekly to daily time scale, or vice versa, is accomplished by merely repositioning one gear — no new parts to buy.

This recorder can be direct float operated or remotely controlled and is available for wall or switchboard mounting, or with cabinet for mounting out of doors directly over the float well. Request BULLETIN 25 for complete details.

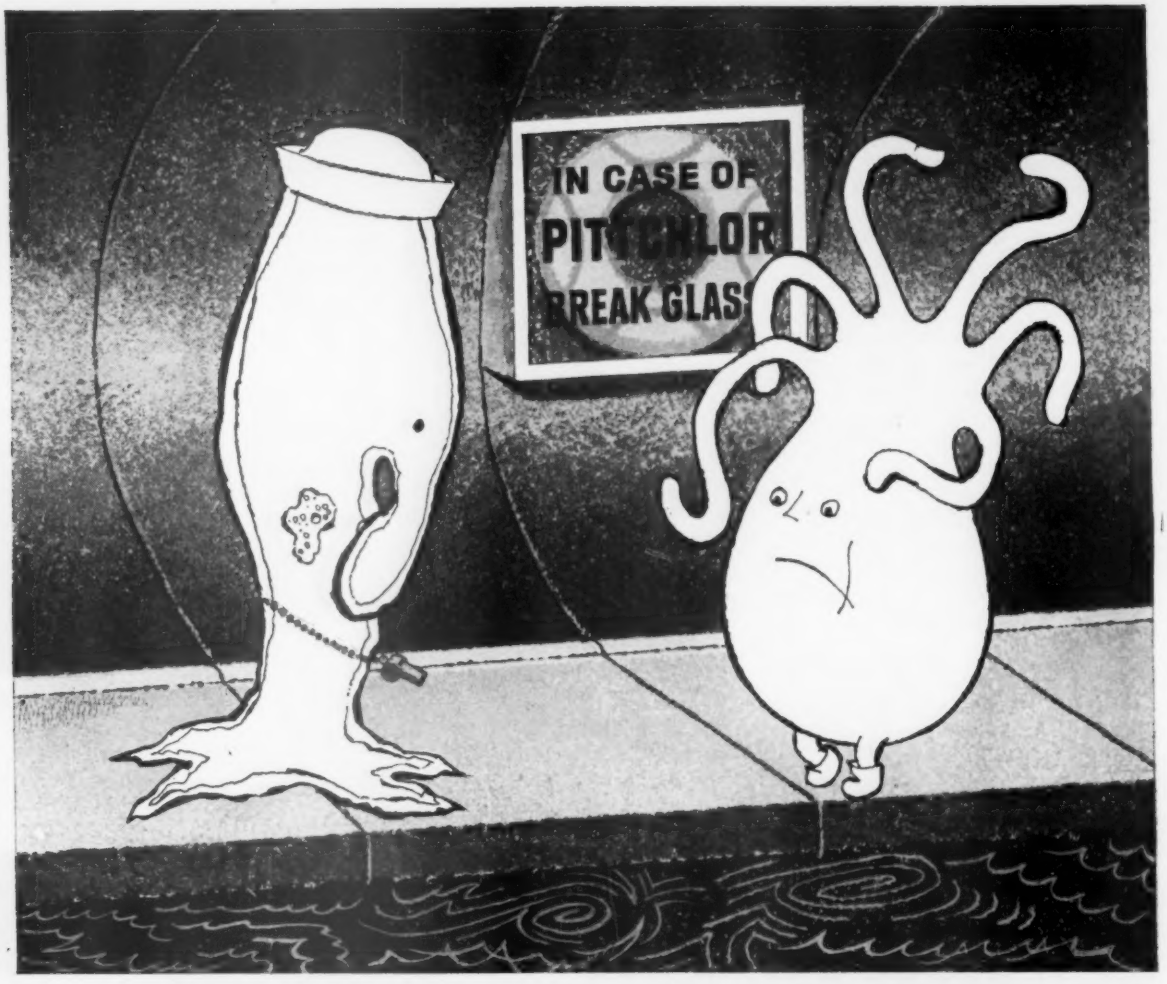
STEVENS HYDROGRAPHIC DATA BOOK

Invaluable for your reference file. Contains technical data on recorder installations, plus a wealth of hydraulic and conversion tables. $1 copy. (No COD's)

LEUPOLD & STEVENS INSTRUMENTS, INC.

4445 N. E. GLISAN STREET · PORTLAND 13, OREGON

Specialists in hydrologic instruments for over half a century.



Remember Orgie, blow that whistle loud if anyone adds PITTCHLOR® to the water!

Seems like every time bacteria and algae turn around these days, somebody is spoiling the fun by treating water with Pittchlor.

Columbia-Southern's high test calcium hypochlorite answers virtually every water or sewage problem presented by chlorine-susceptible bacteria and algae. Its granular form provides quick release of 70% minimum available chlorine. Pittchlor can be applied without delay or fuss either manually or through mechanical feeding equipment.

This dry, free-flowing, highly stable product gives you economically versatile chlorination . . . "pre," "post," "split" or "super" purification in water supplies, algae control in reservoirs, distributing mains disinfection, filter conditioning, B.O.D. reduction, odor control, effluent disinfection, as an aid in coagulation. Why not contact your nearest Columbia-Southern distributor today?

The Columbia-Southern Chemical Corporation, One Gateway Center, Pittsburgh 22, Pennsylvania. Offices in principal cities. In Canada: Standard Chemical Limited.

PITTCHLOR—Packaged in resealable cans, 5 lb. (9 per case) and 3¾ lb. (4 per carton). Also in 100 lb. drums.

COLUMBIA-SOUTHERN CHEMICAL CORPORATION
A Subsidiary of Pittsburgh Plate Glass Company

Equipment News

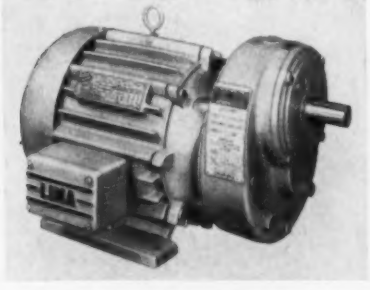
CONTINUED FROM PAGE 13A

where it is first partially dried in a suitable furnace. The products of the combustion are a sterile ash and off-gases. Some of the off-gases from the furnace are used in the preliminary drying step. The remainder of the off-gases are emitted from the furnace at temperatures exceeding 1200° F at which temperature all odor-producing substances are destroyed. The off-gases then go to a water-washer which effectively removes the fly-ash. The sterile ash goes to waste or may be used as fill.

Gearmotors

304

The Lima Electric Motór Co., Inc., Lima, Ohio, has announced the addition of a complete range of sizes of Gearmotors to their present line of "Selective-Speed" Lima Gearshift Drives and Industrial Electric Motors.



Called the Lima Gearmotor, this new line consists of Single, Double and Triple reduction units, integrally motor mounted, with Duti-Rated Lifetime Gearing. Motor capacities are rated from 1 to 125 hp, with output reduction speeds from 780 to 7½ rpm. They are adapted for horizontal foot mounted applications.

Designed to meet almost any service requirement, Lima Gearmotors are available in standard open drip-proof construction for general purpose use; totally enclosed fan-cooled for dusty or high humidity atmospheres and explosion proof for hazardous locations.

CONTINUED ON PAGE 19A

Just off the press-- All about the Thoro System Products

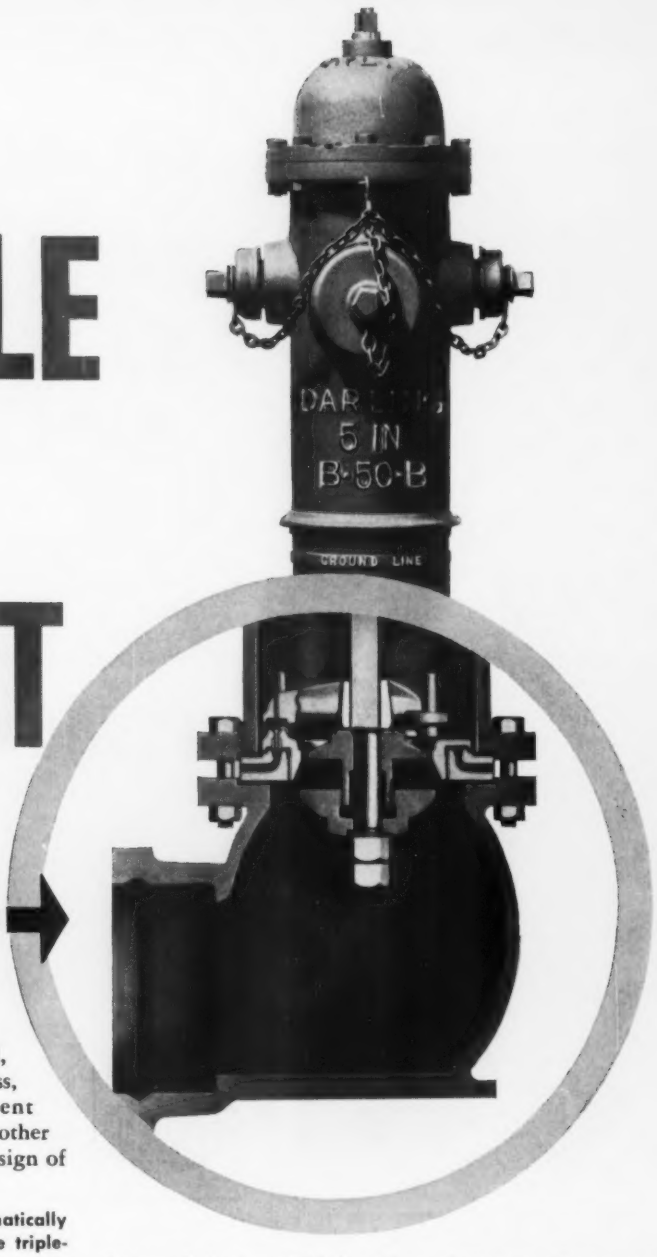
You will want this for your reference file. A complete and concise 20 page brochure, showing treatment and correction for masonry construction.

Know these and many other products in our New Brochure. They are the answer to your maintenance problems.

Standard Dry Wall Products Inc.
NEW EAGLE, PA. CENTERVILLE, IND.

In Darling Hydrants

TROUBLE CAN'T COLLECT HERE...→



EVER SINCE modern fire hydrants were invented, designers have aimed, with more or less success, at positive, complete water drainage to prevent freeze-ups, corrosion and binding. And this is another successful feature of major importance in the design of Darling hydrants. Consider...

1 **An unmatched safety factor is assured by automatically operated, compression type drain valves and unique triple-porting in the main valve seat!**

2 **For an interval during each opening or closing of the main valve, the drain ports are automatically force-flushed by line pressure to remove any sediment. And, when the main valve is closed, these ports remain fully open to assure the release of all remaining water.**

3 **The water drains from the barrel through 3 ports into the bronze drain ring which has 10 to 18 ports to allow water to escape into the ground and eliminate all possibility of clogged drains.**

This and other equally important Darling design features are your assurance of the smoothest, surest, safest hydrant operation known today. For all details, including the range of types and sizes, ask for Bulletin 5710.

TRADE DARLING MARK

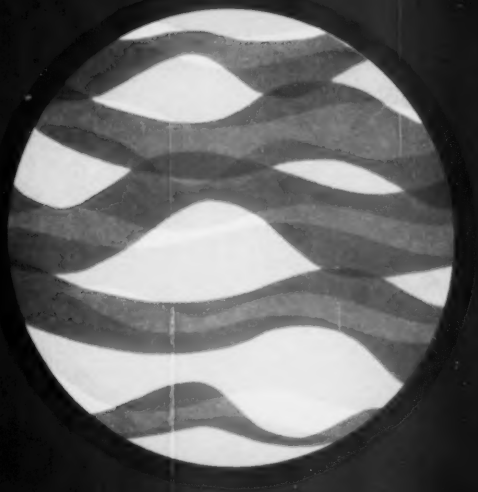
DARLING VALVE & MANUFACTURING CO.

Williamsport 11, Pa.

Manufactured in Canada by The Canada Valve & Hydrant Co., Ltd., Brantford 7, Ont.

OBSTRUCTIONLESS FLOWMETERING

from a trickle...
to a torrent



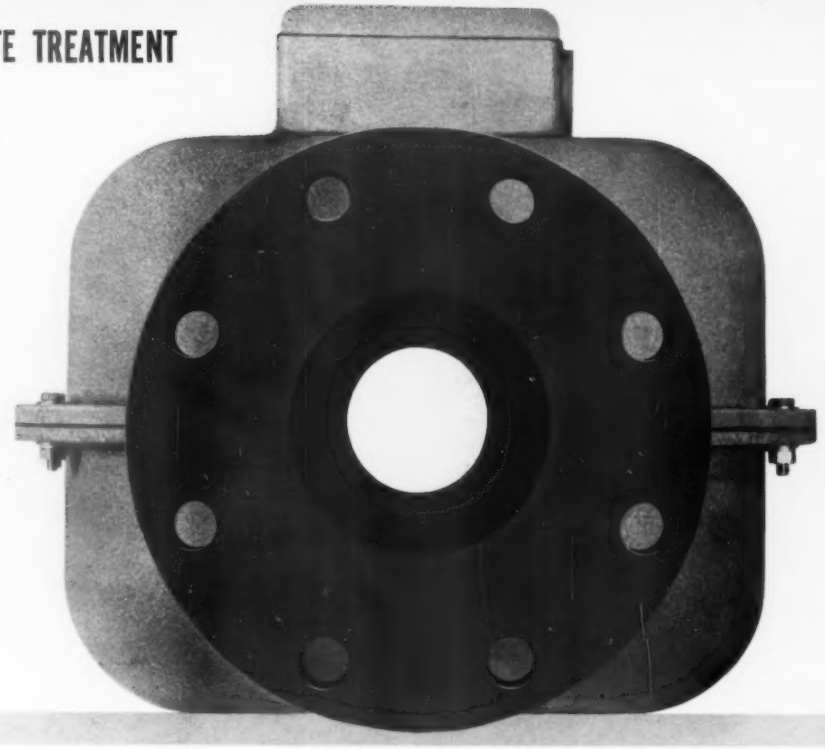
FP

F&P MAGNETIC FLOWMETER

lets you set any flow at full scale . . . from 1 to 30 fps

PROVED IN WATER-WASTE TREATMENT

In service now. No obstructions, no pressure drop, no problems. Meters raw sewage, sludges, effluent. Wide range, high accuracy for billing service.



A turn of a dial gives you full-scale recording for *any* flow rate from 1 to 30 feet per second and permits operation at optimum chart position. This flow range flexibility costs you no more . . . it's an "extra" that's built into every *Fischer & Porter* Magnetic Flowmeter.

If you want to check our claim that F & P gives you more meter for the money, take a good look at these additional exclusives:

- *Any* primary is interchangeable with *any* secondary . . . no custom matching of meter to recorder.
- Remote recording up to 2000 feet from the meter.
- Power requirements substantially reduced . . . 117v, 60 cycle a-c in *all* sizes.
- Can measure reverse flows *without auxiliary equipment.*
- Fast response time . . . 2-3 seconds full scale.
- Adjustable damping of flow signal.

Before you buy *any* magnetic flowmeter, investigate the advantages of F & P's magnetic flowmeter. Get in touch with the F & P field engineer nearest you and write for Catalog 10D1416. Fischer & Porter Company, **239** County Line Road, Hatboro, Pa. In Canada, write Fischer & Porter (Canada) Ltd., 2700 Jane Street, Toronto, Ontario

FP FISCHER & PORTER COMPANY *COMPLETE PROCESS INSTRUMENTATION*

Equipment News

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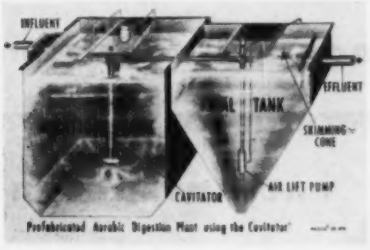
Factory-Built Sewage Plant Shipped as a Complete Plant

305

Yeomans Bros. Co., Melrose Park, Ill., has developed sewage treatment systems for small installations that can now be shipped as complete plants. Seven sizes are available in



Prefabricated Aerobic Digestion Plant using the Cavitator

this Cavitator aerobic digestion plant, ranging from 2000 to 7500 gpd. Depending on the design criteria, this factory-built plant can handle a subdivision of 75 persons, a 30-unit trailer park, 325 student elementary school, factory of 165 persons, a 54-unit motel or a 38-bed hospital.

Factory fabrication of the complete plant offers the lowest cost way to provide a simply-operated, effective waste treatment plant. Engineering costs are reduced, as are on-site construction costs. Mass-assembly of components at the factory also contributes to the lowered cost picture.

Level Control For Bulk Bins

306

Convair, Pittsburgh, Pa., has developed a new Bin-Vue level indicator and control which features an easy-off cover and a fail safe device.

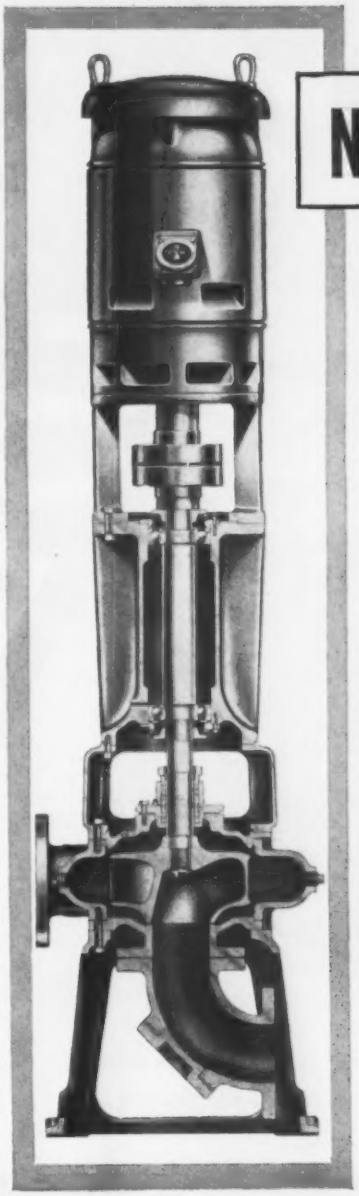
Access to the unit is gained by simple push-up, push-down and pull-off motion on the single-piece cover. The cover is held in place by compression of an "O" ring on the mounting flange.

A limit switch, acting as a fail safe device, is activated 18 times a minute and can be connected for visible or audible control. This switch may also be connected to a relay circuit for automatic control. Failure of any part of the Bin-Vue will later the signal

CONTINUED ON PAGE 21A

For higher pumping efficiency

of solids in suspension!



NEW

Fairbanks-Morse

5440A Non-Clog Pumps

Ideal for pumping unscreened liquids with large solids in suspension

- industrial wastes
- sanitary sewage disposal
- industrial processes

Here is your answer to higher efficiencies wherever you are pumping solids in suspension!

All-new Fairbanks-Morse 5440A Non-Clog Pumps feature quick, easy convertibility between any of the many vertical and horizontal types. Power requirements of the pump are always perfectly matched to the electrical and mechanical components. Precision-machined centering fits assure accurate alignment. Exclusive F-M bladeless impeller design minimizes maintenance by preventing clogging from solids and stringy material. The 5440A is only one of many F-M solids-handling pumps designed to meet a broad range of requirements. For information, write Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago 5, Ill.

Ask for new 5440A BULLETIN!

FAIRBANKS-MORSE

a name worth remembering when you want the BEST

ELECTRIC MOTORS • DIESEL, DUAL FUEL AND GAS ENGINES • PUMPS
COMPRESSORS • GENERATORS • MAGNETOS • HOME WATER SYSTEMS

HERSEY

Compound Meters

have never been equaled for the accurate registration of all rates of flow, and for many years have maintained long and consistent records for performance at a minimum of cost.

All Bronze Case
Sizes 2"- 3"- 4"- 6"
Inclusive
as illustrated
also
Iron Case Meters
(not shown here)
in sizes 8"- 10"

HERSEY
1859 1959
100 YEARS OF PROGRESS

HERSEY

HERSEY MANUFACTURING COMPANY

(Established 1859)

DEDHAM, MASS.

BRANCH OFFICES: NEW YORK — PORTLAND, ORE. — PHILADELPHIA — ATLANTA — DALLAS — CHICAGO
SAN FRANCISCO — LOS ANGELES

"You can't buy a better Water Meter than HERSEY."

Equipment News

CONTINUED FROM PAGE 19A

and stop or start other equipment controlled by the Bin-Vue.

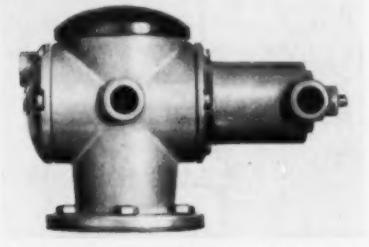
In operation, a 1/100 hp motor turns a four blade paddle at 9 rpm by means of a torsion spring. The paddle turns continuously as long as no material touches it. When material makes firm contact with the paddle, the paddle stops. The motor continues to run, turning the spring until it activates a limit switch. The switch kicks off the motor and any other equipment connected to the indicator. When the material falls away from the paddle, the torsion spring reactivates the paddle and, in so doing, unwinds from the limit switch, starting the motor and putting the entire unit in operation again.

Valve Positioner

307

Conoflow Corp., Philadelphia, Pa., has developed the Model J Positioner, a new and different valve positioner.

The Model J, a top mounted integral positioner, is capable of matching or exceeding the speed and sensitivity of modern pneumatic controllers. It combines the proved force-



balance design with a radically new pilot-operated relay valve, providing high power output and maximum sensitivity.

The Model J is an extremely versatile positioner suitable for use on both cylinder and diaphragm type actuators. It is capable of an infinite number of stroke lengths up to 8 inches in any combination of control forms through a variety of models. Linearity is guaranteed to be better than 1% regardless of stroke length. The Model J responds to signal changes as low as .001 psi. It is un-

CONTINUED ON PAGE 23A

for Distribution Digging there's nothing like it ✱

TIGHT QUARTERS. Narrow tree lawns, trees, utility poles, intersecting service lines—in conditions like these nothing digs trench like a Cleveland "Baby Digger."

PRECISION TRENCHING. Note how precisely this Cleveland 92 is placing spoil on the sidewalk—off the well-kept lawn. Trench walls are smooth and straight. Backfilling will be fast, easy and clean. The "Baby Digger's" fine balance on smooth, friction-free crawlers contributes to its precision-maneuverability.

ONLY 4' 6" WIDE. The narrow Cleveland 92 digs easily past obstructions, maintains steady, high trench production. More than 30 usable wheel and crawler speed combinations give it the right combination of power and speed for digging all soils—in mud, frost, shale or rocky ground.

✱ the Cleveland "Baby Digger," of course

If city trenching is your job . . . it's the trencher for you

The CLEVELAND TRENCHER Co.

20100 ST. CLAIR AVE. • CLEVELAND 17, OHIO

Good Everywhere ®

install valves *without* interrupting service!

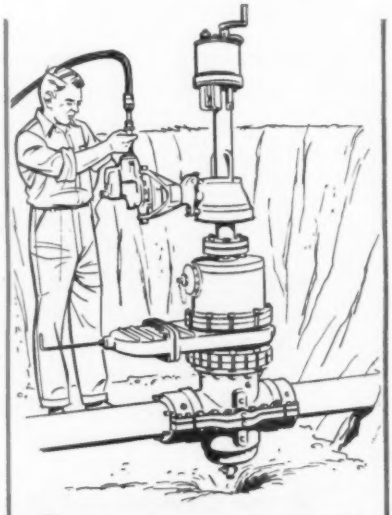
You can add needed gate valves anywhere in your water system—without a shut-down—when you use **MUELLER®** Inserting Valves. These valves are specifically designed to be quickly, easily installed in any existing 4″, 6″ or 8″ cast iron main under full service pressure. There is no loss of water, no interruption of service and no loss of fire protection.

The gate valve mechanism of the Mueller Inserting Valve is identical to that of dependable Mueller AWWA Gate Valves and Mueller Tapping Valves. This permits standardizing on one type of valve mechanism for all your valve needs.

This product feature is typical of the attention to detail in research, design and engineering that becomes a part of every Mueller product produced for the water works industry.

here's how with Mueller Inserting Valves

1. Bolt sleeve halves to main and calk end joints.



2. Cut out section of main with Mueller Drilling Machine.

3. Lower valve plug assembly into main and secure.

MUELLER CO.
DECATUR, ILL.

Factories at: Decatur, Chattanooga, Los Angeles;
In Canada: Mueller, Limited, Sarnia, Ontario

Equipment News

CONTINUED FROM PAGE 21A

affected by vibration. Increasing or decreasing outputs may be applied to either the top or bottom of an actuator in a single mounting of the positioner. Zero adjustment is readily accessible and can be made while in operation.

Completely enclosed and weatherproof the Model J is suitable for use in the most adverse weather conditions and plant atmospheres. All moving parts are protected by an anodized aluminum housing with a corrosion resistant finish.

Plastic Gate Valves With Socket-Weld Ends

208

Vanton Pump & Equip. Corp., Hillside, N. J., has announced a complete line of socket-weld Flex-Plug Plastic gate valves. Further extending the present line of screwed end valves, the socket weld line is available in sizes from ½ to 2 inch in both PVC or styrene-copolymer.

The Flex-Plug Valve, first of its kind, offers the combined features of flow with close throttling control. The combination of these two features of a gate and globe valve makes the Flex-Plug one of the most versatile available. Now, with the addition of socket-weld ends, the unique plastic Flex-Plug valves can be used on the most severe services.

Portable, Centrifugal Pumps

309

Homelite, a division of Textron, Inc., Port Chester, New York, has announced three new 3 in. self-priming, centrifugal pumps, with capacities of 18,000 gallons per hour that were specifically designed for all purpose use by utilities, municipalities and industrial plants.

Completely new in engine and pump design, the Homelite "300" pumps give long, dependable service on the job and are easy and economical to operate. The new Model 8 engine

CONTINUED ON PAGE 25A

Here's why more and more waterworks men are specifying

Sparling meters...

Sparling propeller meters are accurate, maintenance free and last for years

There are reasons for the increasing use of Sparling Propeller Meters. The main reason is that *totalization is Sparling's primary step*... after all, the usual purpose of metering is to determine the total amount of water. Rate indication and recording is Sparling's *secondary step*. Furthermore, with Sparling's free-flow design there is practically *no pressure loss*, an important economic consideration in flow measurement. Sparling meters are guaranteed accurate within 2% when properly installed. Finally, Sparling meters enjoy long life, free of any real problems of wear, incrustation, and corrosion, Recently, a 4-inch meter was "opened" for routine inspection, after 20 years of accurate service, and it showed no wear affecting accuracy. Start towards good metering now, write today.

Write for this informative brochure on the Sparling Line of Water Metering and Control Equipment. No obligation. Sparling Meter Company, 225 North Temple City Boulevard, El Monte, California.

Sparling meters

Other Sparling Offices: ATLANTA 3 • CHICAGO 4 • CINCINNATI 2 • DALLAS 1, TEXAS • DENVER 6 KANSAS CITY 6, MO. • ROSELLE, N. J. • SAN FRANCISCO 24 • SEATTLE 99 • TORONTO, CAN. • ROMFORD, ENG.

CARE

makes the difference in Pennsalt® Chlorine

care *in manufacturing* . . . Pennsalt® Water Works Grade Chlorine gets *extra* purification to insure absolute adherence to water works standards.

care *in handling* . . . Pennsalt Water Works Grade Chlorine is made, packaged, and shipped only under Pennsalt supervision, to eliminate any chance of contamination.

care *in packaging* . . . Containers for Pennsalt Water Works Grade Chlorine are cleaned and inspected before each use, with every precaution taken to eliminate foreign matter that could foul your chlorinators.

Important, too, is Pennsalt's care in planning that assures you ample supply when your needs grow. Pennsalt Water Works Grade Chlorine is available in 100- and 150-lb. cylinders; in one-ton containers and in multiple-unit rail cars. Call or write Pennsalt today for fast service.

For faster sedimentation, higher efficiency, in your sewage plant . . . use Pennsalt® Ferric Chloride, anhydrous or liquid.

See our Catalog in CMC

INDUSTRIAL CHEMICALS DIVISION

PENNSALT CHEMICALS CORPORATION

3 Penn Center, Philadelphia 2, Pa.

Chicago • Detroit • New York • Philadelphia • Pittsburgh • St. Louis • Appleton • Atlanta
Airco Company International, New York • Pennsalt Chemicals of Canada Ltd., Oakville, Ontario

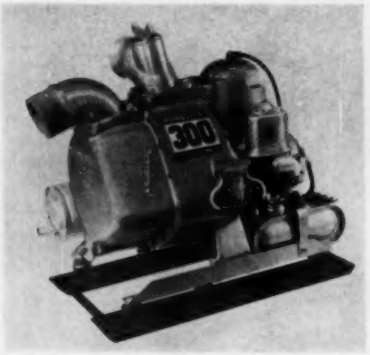
Pennsalt Chemicals
ESTABLISHED 1850

In the West, Pennsalt inorganic chemicals are available through Pennsalt of Washington Division, with plants at Tacoma, Washington and Portland, Oregon.

Equipment News

CONTINUED FROM PAGE 23A

starts quickly even in the coldest, wettest weather. Simple, rugged, two-cycle engine design has fewer moving parts and is easy and inexpensive to maintain. New ceramic-coated seal, standard equipment on these units, lasts five times longer than the common cast iron-bronze seals on ordinary pumping jobs; fifteen to twenty times longer under highly abrasive pumping conditions. New impeller and volute designs result in fast self-priming, greater discharge pressure and high suction lift. Self-cleaning construction permits handling of



muddy and sandy water without clogging. All three models are guaranteed to pump and prime at 28 feet above water level.

The quiet, slow-speed, "300" Model 8S3-1 is ideal for use in city and suburban areas and for emergency night operations where noise is a problem.

Pearson Pipe Pipeline Detector

310

Tinker & Rasor, San Gabriel, Calif., has announced the development of a Pearson type detector for pipeline inspection and location. While this principle of instrumentation is not new, Tinker & Rasor's Model PD is believed to be superior to any available equipment of this type now in use superior both in sensitivity and in size.

The Model PD Pearson detector is extremely useful to public utility, pipeline or municipal organizations in the performance of three types of work. It can locate discontinuities in protective pipe coating down to minute perforations of the wrappings in pipe buried at normal depths and can locate these "holidays" from the surface of the ground and without uncovering the pipe. This is possible with a Pearson type detector only when the soil around the pipe is fully compacted and has a moisture content. The PD detector can locate electrical shorting between two pipelines or between a pipeline and some other metal structure. Finally, it can trace an individual pipeline including its branches, through a maze of buried pipe in city streets when the systems are not electrically connected. This is true even when the line being checked is closely parallel or stacked with other lines in a trench.

In operation, the Model PD Pearson detector makes use of a powerful transistorized oscillator. This oscillator is powered by any standard 12 volt auto battery and develops 25 watts of 750 cycle audio signal with a conversion efficiency of 70 per cent.

CONTINUED ON PAGE 33A

To appease the GOD OF FIRE

Vulcan was the Roman God of Fire and each year on August 23 Roman families threw fish into a fire as a sacrifice to appease his anger. From the earliest dawn of civilization, fire has been to Man both friend and foe. In modern times, municipal fire fighting has long been a matter of an efficient fire department and an adequate water supply. This is where the water works man enters the picture.

On water depends the safety of human life and property—and lower fire insurance rates. The first fire-engine pump mentioned in history was used in Egypt in 200 B. C. Great and marvelous improvements in fire fighting equipment have been made in the past 22 hundred years. But all such equipment would be useless without water. A modern fire department in action is a spectacular performance. But it is the water works man "behind the scenes" who makes it possible. Give him some of the credit.

This Series is an attempt to put into words some appreciation of the water works men of the United States.

M&H VALVE AND FITTINGS COMPANY
ANNISTON, ALABAMA
SUBSIDIARY OF WALWORTH

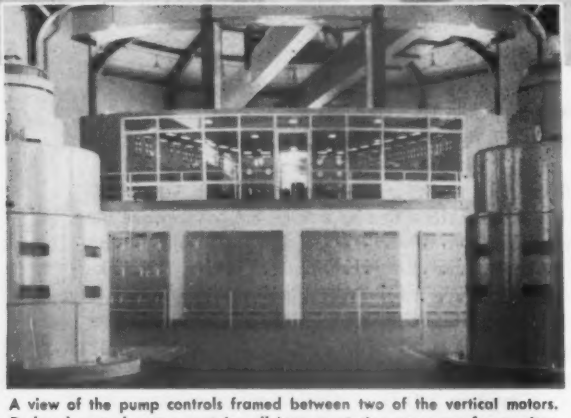
One of two (2) main operating corridors showing individual filter control stations whose modern design permits initiating and carrying out the backwash cycle automatically.

CITY OF DETROIT

Department of Water Supply
NORTHEAST FILTER PLANT & PUMPING STATION
Gerald Remus, Dept. Gen. Mgr.

General Contractors
Bryant & Detweiler, Detroit (Pumping Station & Foundation)
Grove-Sheppard, Wilson & Krug, New York (Filter Bldg.)

Equipment Contractors
Municipal Service Co., Kansas City (Filter Equipment)
Stanley Carter Co., Detroit (Metering Equipment)



A view of the pump controls framed between two of the vertical motors. Enclosed control center contains all instrumentation necessary for monitoring operation of station. Large dial gauges provide continuous indication of station performance.

Plant engineer, George Dehem, inspects an individual filter control station with one of his filter attendants. All filter operation is supervised from this control panel.

ONE SOURCE
ONE RESPONSIBILITY

B-I-F

B-I-F INDUSTRIES
BUILDERS-PROVIDENCE • PROPORTIONEERS • OMEGA

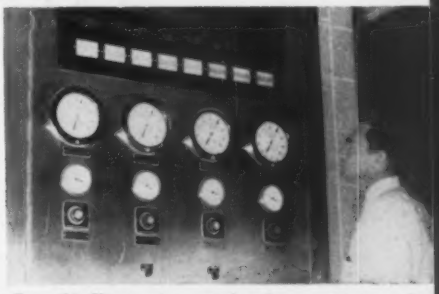
Detroit Equips New Northeast Filter Plant with

INTEGRATED EQUIPMENT OF PROVEN PERFORMANCE FROM "SINGLE RESPONSIBILITY" SOURCE!

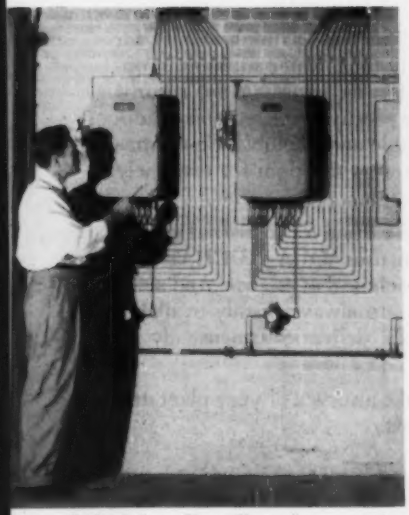
Modern Builders-Providence Controls and Equipment Installed at Detroit's 192,000,000 GPD Water Supply System

Supplying the tremendous water demands of the country's fifth largest municipality is no small task. The complex nature of such an operation requires complete integration of all control equipment . . . for maximum efficiency, operation economy and systems reliability.

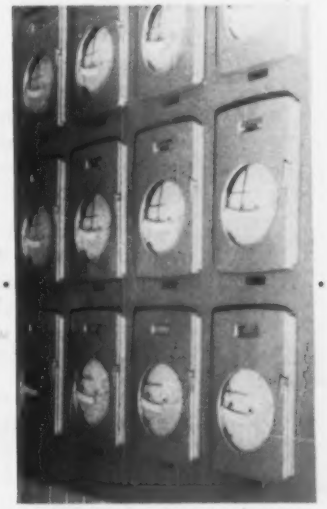
B-I-F Industries as a single, responsible source . . . offering nationwide sales and service through local offices . . . was able to supply the type of equipment (supervisory control, filter control, chemical feeding and related functions) that means immediate and long term savings in time and money. For particulars, write **B-I-F Industries, Inc., 350 Harris Ave., Providence, Rhode Island.**



From this filter master control and annunciator panel, the flows through four batteries of twelve filters each can be observed and regulated to meet varying demands. Audible alarms and lights indicate any departure from desired conditions . . . allow operator to maintain optimum operation.



Each of these filter effluent flow summation units totalizes the flows through 12 individual filters and transmits a signal proportional to total flow to instruments located at key locations throughout the plant. In addition, the output of the four summation units is added to obtain total plant flow.



All plant functions for which permanent operating records are required are displayed on this central recorder panel thus permitting operating personnel to note trends of the various functions and departures from normal conditions.

One of the Omega Gravimetric feeders used for alum — others are used for activated carbon. These units provide reliable and accurate proportioning of chemicals to water being treated regardless of plant output variation.

it's too late when they start telling you!

AQUA NUCHAR

ACTIVATED CARBON FOR TASTE AND ODOR CONTROL

Here's the best way to avoid embarrassing taste and odor complaints. Stop them before they start . . . with daily threshold odor tests and AQUA NUCHAR!

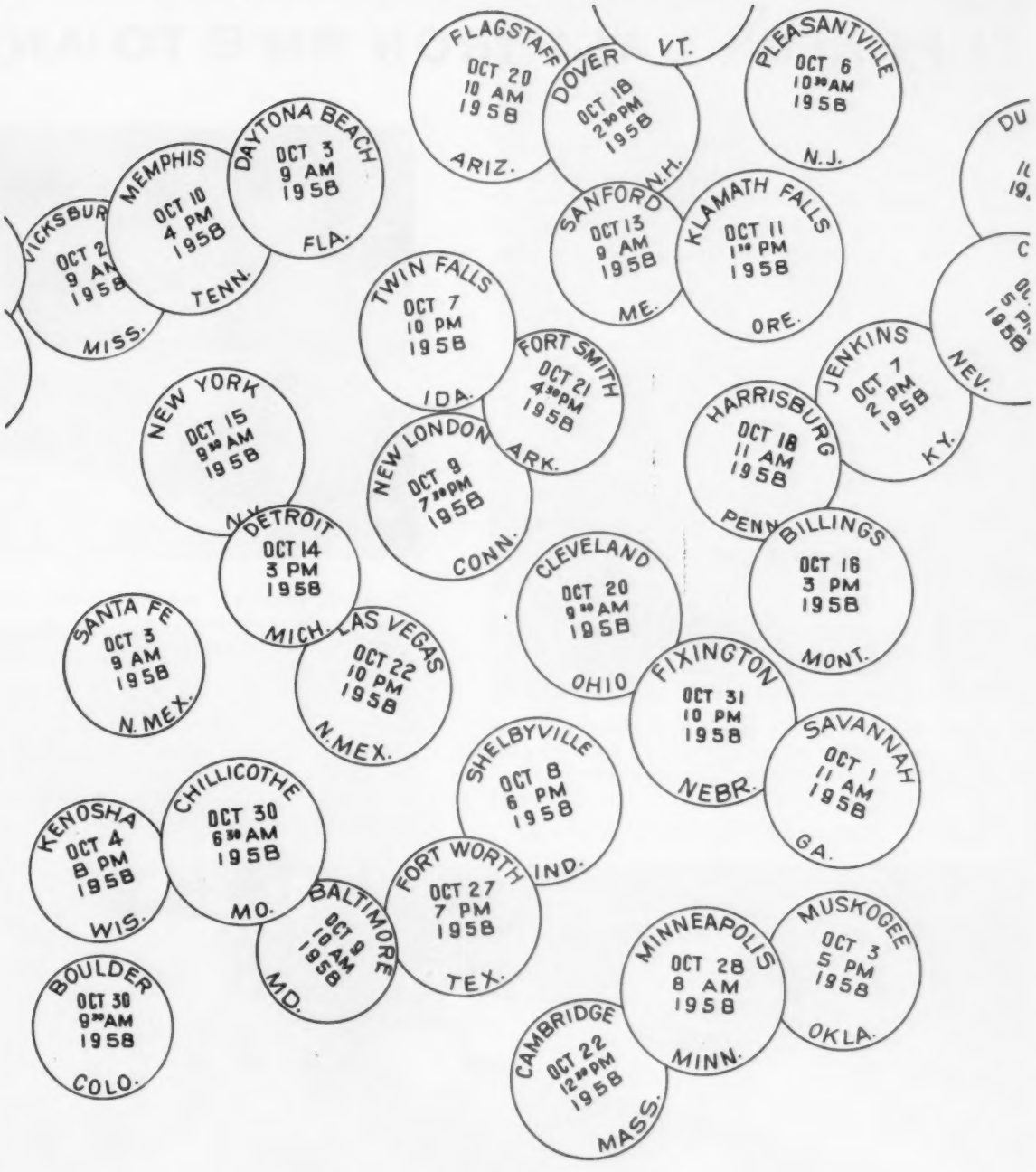
AQUA NUCHAR activated carbon has high affinity for all substances that commonly taint water supplies. Properly applied in sufficient dosage, it efficiently adsorbs tastes and odors from algae, decaying vegetation, trade-wastes and other matter, soluble and insoluble. Concentrations required average as low as 2-5 ppm for extremely economical control.

We have produced activated carbon for industrial use for over 40 years, so when you use AQUA NUCHAR you benefit by our experienced technical assistance. And since stocks of AQUA NUCHAR are always readily available from 25 strategic warehouses, deliveries can usually be made within 12-24 hours.

We would be pleased to make a survey of your plant and to estimate your requirements.

industrial
CHEMICAL SALES
division west virginia pulp and paper company

230 Park Ave., New York 17 · Philadelphia National Bank Bldg., Philadelphia 7 · 35 E. Wacker Dr., Chicago 1 · 2775 S. Moreland Blvd., Cleveland 20



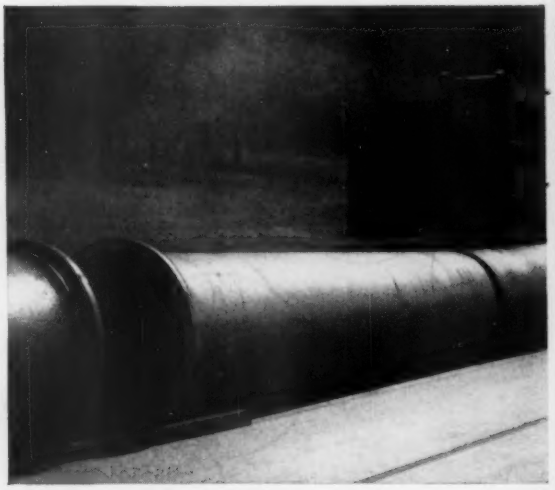
From North, South, East and West, officials wrote in to say...

"I PREFER CAST IRON PIPE TO ANY

Recently a questionnaire was mailed to water utility managers all over the U.S.A. One question asked was: *What kind of pipe do you prefer and why?* With 42 states heard from, the vote is overwhelmingly in favor of cast iron! Here are typical comments:

"Our main system is entirely cast iron. It holds up good in 'hot' soil conditions and will not rust out. We are nearing the century mark on some of it, and it gives no trouble."

—Kansas



"Strength, resistance to corrosion . . . economical first cost, low maintenance and operating cost, good flow characteristics."

—North Carolina

"Long life—strength—ease of tapping. We are located, as a city, over old mine workings, and subsidence of earth causes trouble on other pipe to a greater extent than on cast iron."

—Illinois

OTHER KIND"

"We have a very hilly city, pressures up to 170 p.s.i. Some of our mains are 90 years old. They were cast iron and are still giving good service."

—Iowa

"Having been used over a long period of time, it has proved its worth. Structurally safe. Easy to repair."

—California

So many good reasons . . .

- LONG LIFE. The cast iron pipe you install today will be performing economically a hundred years from now.
- HIGH CAPACITY FLOW. Cement-lined cast iron pipe will deliver the full-rated flow all through the years. No other pipe, size for size, can carry more water.
- CORROSION RESISTANCE. Long life proves it. Most water utilities are still using the first cast iron pipe they installed.
- GREAT BEAM STRENGTH. Cast iron pipe resists the effect of heavy traffic, shifting soils.
- TREMENDOUS LOAD RESISTANCE. 6" cast iron pipe (Class 150) withstands a load of nearly 9 tons per foot!
- PRESSURE-TIGHT JOINTS. You have a complete choice of leakproof, easy-to-assemble joints. You need a minimum of tools and work crew.
- EASE OF TAPPING. No tapping saddles needed. Takes threading best of all kinds of pipe.

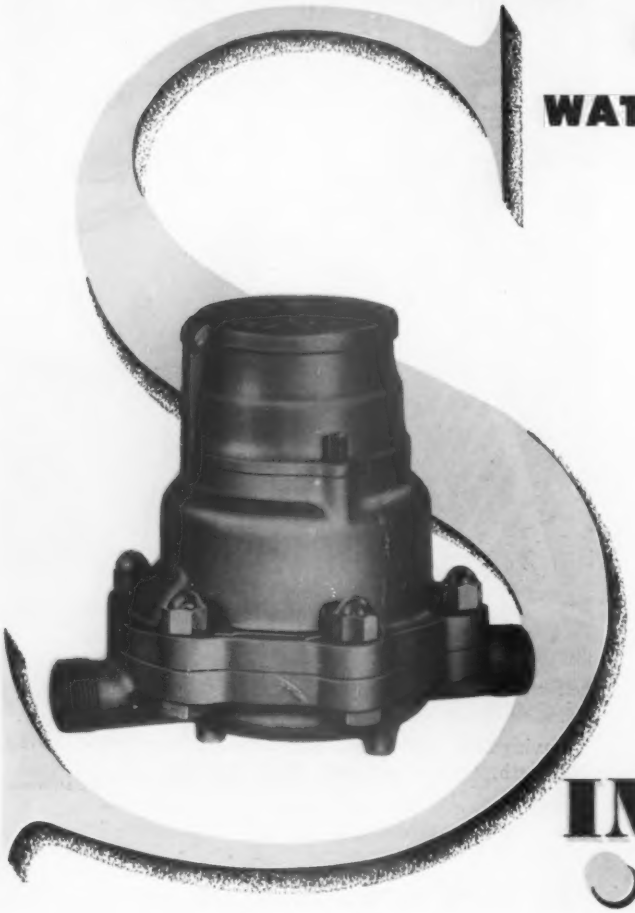
. . . good reasons for you *to choose*

CAST IRON PIPE

Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 3440 Prudential Plaza, Chicago 1, Ill.

AMERICAN METERS

HAVE WHAT THE WATER SUPERINTENDENT WANTS



American Solid Casing Meter

IMPLICITY

- FEWEST PARTS OF ANY COMPLETE METER
- FULL INTERCHANGEABILITY
- EASIEST REPAIR

Simplicity in the design of a water meter is important to the Water Superintendent because it reduces maintenance costs.

AMERICAN METERS are simple, uncomplicated — easy to take apart and put together — and best of all you can't put them together incorrectly. AMERICAN METERS have the fewest parts of any complete meter and all parts are interchangeable from one meter to another. Worn parts can be replaced individually without having to buy costly "unit assemblies". The rugged construction of AMERICAN METERS results in many years of trouble-free service. All this means lower parts costs, lower inventory cost, lower repair costs!

Yes, AMERICAN METERS are the answer to the Water Superintendents request for Meter SIMPLICITY.

Replaceable Measuring Chamber Assembly

BUFFALO METER COMPANY
INCORPORATED

2909 Main Street
Buffalo 14, N. Y.

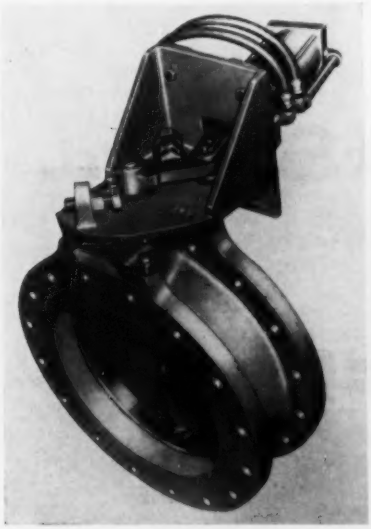
Equipment News

CONTINUED FROM PAGE 25A

Improved Butterfly Valve

311

F. B. Leopold Co., Inc., Zelienople, Pa., has announced that a number of



new, improved features are offered by the new "Advanced Design" Leopold AWWA Butterfly Valve.

In this design, the new "Uni-Wedge" method of seat retention allows the seat retaining pressure to be externally adjusted with the valve in place in the line. Only two seat retaining screws are utilized, and these are not in contact with the flowing medium, so corrosion is not a problem. The valve disc and rubber seat arrangement at the disc hub are so designed to eliminate premature seat failure.

Built and tested in accordance with applicable AWWA specifications, every Leopold Butterfly Valve is equipped with a rugged flanged valve body, precision molded, nylon cloth reinforced, resilient rubber or synthetic seat, and heavy-duty corrosion-resistant operating parts.

Vibratory Feeder

312

Syntron Co., Homer City, Pa., has developed a new special model heavy-duty electromagnetic vibratory Feeder specifically designed for high capacity feeding where installation space is limited.

These special model Feeders combine two standard electromagnet drive units to provide the power necessity to convey heavy materials at fast feeding rates through extra long trough.

The separate electromagnet drives, which operate in alternate coordination, are mounted above and below the trough to eliminate the extra length required for standard electromagnet drive mounting, adapting them very practically to easy installation in restricted space.

Wide range of models offers maximum feeding capacities ranging from 25 to more than 1000 tons per hour in dry materials weighing approximately 100 pounds per cubic foot.

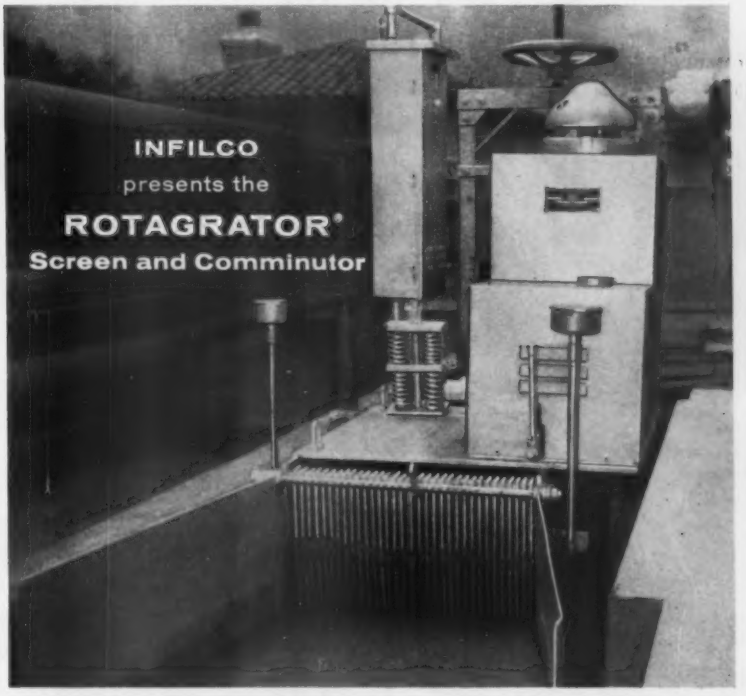
The Feeders can be built with standard or special troughs or stainless or regular steels. They can also be equipped with dust-tight covers for magnets and troughs and with dust seal attachments for trough inlets and discharges for materials which necessitate dust control.

Flow Transmitter

313

The Hays Corp., Michigan City, Ind., has developed an entirely me-

CONTINUED ON PAGE 36A



...for faster, more complete
COMMINUTION OF SEWAGE SOLIDS!

Most materials are handled in a single pass. Rollers at the bottom of a curved bar screen intercept heavy solids—lighter ones are raked down automatically. Any over-size comminuted solids are automatically rescreened and returned to the comminuting rollers until reduced to a size that permits passage through the screen.

No matter what the load may be, the unit operates continuously without harm to the mechanism, because of its rugged construction and safety devices incorporated in its design.

The "ROTAGRATOR" screen and comminutor is a completely packaged unit ready for simple and easy installation. A full range of sizes is available. For complete information write today for Bulletin 5150-A.

Over 60 years of engineering leadership in water, sewage and waste treating equipment.

INFILCO

Infilco Inc.
General Offices:
Tucson, Arizona
P.O. Box 5033

Field offices throughout the United States and other countries.

Complete lines of proven equipment for Clarification, Softening, Filtration, Ion Exchange, Aeration, Flotation, Commutation, Biological Treatment, and Atomized Drying and Incineration. 59421

PRIMITIVE WASHDAY...Washing in a river —inefficient and exhausting—is still done in many undeveloped countries. Clothes never really come clean and are often contaminated.

THE MODERN WOMAN merely turns a switch...her wash is done automatically in clear, pure water—most of it carried through cast iron pipe.

U.S. PIPE

FOR WATER, SEWERAGE AND
U. S. PIPE AND FOUNDRY COMPANY

but better than ever today!

From mine-to-line, U. S. Pipe controls quality

America's water systems... finest on earth... didn't just happen.

They are made possible by forward-looking water officials and the dependable cast iron pipe that carries most of the nation's water.

We supply much of that pipe. To make sure it's as good as human care, skill and integrity can make it, U. S. Pipe controls every production step. From mining of ore to modern packaging, our pipe is tested, checked and rechecked for quality every step of the way.

Dependability is built into U. S. Pipe... literally, from the ground up!

PROBING THE EARTH... Our own iron ore is mined from deposits as much as two miles distant from the portal.

INSPECTING HOT PIPE... U. S. Pipe, just removed from the mold, is checked and inspected for quality.

SCIENTIFIC TESTING... Determining the chemical properties of U. S. Pipe – one of many quality checks.

INDUSTRIAL SERVICE CAST IRON

Birmingham 2, Ala. *A wholly integrated producer from mines and blast furnaces to finished pipe.*

New Equipment

CONTINUED FROM PAGE 33A

chanically frictionless and liquid-free Flow Transmitter.

The new Hays transmitter has no torque tubes, stuffing boxes, knife edges or bearings. Transmitter is of the bellows-actuated type—the differential transformer core moves directly with the bellows. Liquid-free, the only sensing unit is the single element bellows.

Available in standard industrial ranges from 20 to 600 in. water differential, the new transmitter was specifically designed for use with the new Hays Universal Electronic Recorder. Together, these instruments form a system to measure, indicate, and/or record differential pressure.

Compactness is furthered by the equalizing and shutoff valve assembly being self-contained within the unit housing. For pipe mounting, unit can be mounted on a convenient vertical section of 2-in. pipe. Wall mounting bracket is also available.

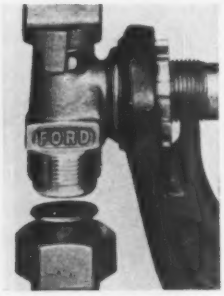
can YOUR water meters be installed with one hand . . . in 9 seconds?

NOW . . . low-cost Ford yokes make possible new standards of speed and simplicity in meter setting or removal

The Ford yoke shown above can make water meter installation a lightning-quick operation for your maintenance crews . . . cut meter installation time and cost.

Here's how: With the Ford yoke holding inlet and outlet piping in fixed position (see photo), the meter is 1) simply set in place on the yoke, and 2) made water-tight by a manual expansion connection. The complete job takes only 9 seconds! Yet, speed isn't the only advantage of a Ford yoke. Equally important: Subsequent meter changes need never disturb service line spacing or alignment, eliminating a frequent source of trouble and leaks.

Millions of Ford yokes are in service all over the nation and Latin America . . . proving every day that there is almost no installation that can't be made better with a Ford yoke. Find out now how much maintenance time and money these low-cost units can save you.



Improved Valve, which can be provided as part of Yoke, does away with loose connecting ring, includes standard copper tube nut. Result is easy-to-make, leak-proof joint.

For more Information and Sample, write

FORD

FOR BETTER WATER SERVICES

THE FORD METER BOX COMPANY, INC. Wabash, Indiana

Outside Readers For Water Meters

31

Visi-Meter, Inc., Kansas City, Kansas, has available the Visi-Meter, for remote recording and indicating water meter flows.

The device is attached to the fraction hand of the meter register and a cable connects the meter to a counter which is then located outside of the house or building.

The unit is guaranteed to maintain the .01 per cent accuracy required of regular water meter registers.

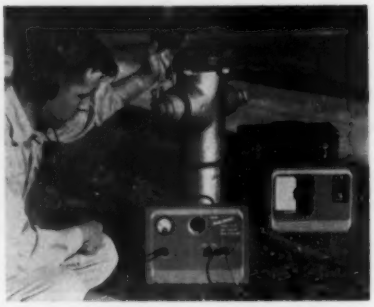
According to the company, the Visi-Meters are now in use in approximately 75 cities throughout the nation.

Transistorized Pipe-Leak Locator

315

The Goldak Co., Inc., Glendale, Calif., has developed the new "Dualtronic," all-transistor, Model LC-5T, Pipe Locator-Leak Detector.

The new "Dualtronic" features transistors, an etched circuit, packaged stages, and an improved high gain crystal microphone. Only one type battery (flashlight cell) is required through the instrument and they are obtainable anywhere. No "B" batteries, such as 45 and 67½ volt sizes are required.



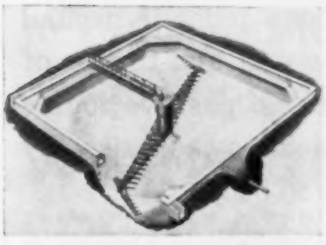
The Model LC-5T is extremely simple to operate and has pinpoint accuracy in locating and tracing pipes, cables, and conduit, measuring depth, detecting laterals or service lines, and locating valves, risers, valve caps, and manhole covers. By simply flicking a

CONTINUED ON PAGE 39A

PRIMARY AND SECONDARY SETTLING BASINS at O. N. Stevens water filtration plant, Corpus Christi, Texas, are equipped with Link-Belt Type "S" Circuline sludge collectors. This new 48-mgd plant can handle a 50% surge easily, 100% in emergencies.

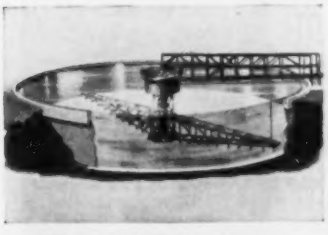
Four types of LINK-BELT Circuline collectors

offer positive sludge removal

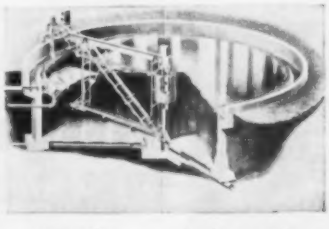


TYPE "S" — specially designed for square and rectangular tanks. As collector revolves, pivoted arms on ends of rakes adjust to thoroughly remove sludge from basin corners.

TYPE "R" — available in models for bottom feed, side feed or cross flow applications . . . in a wide range of sizes. Pitched blades gently convey sludge to center of tank.



TYPE "T" THICKENER — for rugged duty. Similar to "R" collectors except for heavier design. Furnished with fixed rake and automatic or manual lift types.



TYPE "C" — uses simple, positive traction drive to rotate bridge. Slow-speed straightline collector, with long-wearing, corrosion-resistant chains, removes sludge.

There's a design to fit any requirement of tank capacity or construction

THERE's no problem of septicity in settling tanks where Link-Belt Circuline collectors are used. Traveling smoothly and gently, they assure minimum disturbance of flow and the greatest possible concentration and removal of solids in least time.

This efficiency is typical of all the equipment in the complete Link-Belt line for water, sewage and industrial liquids treatment. And it testifies to the value of Link-Belt's more than 35 years' experience in sanitary engineering.

Link-Belt will gladly work with your consultants and chemists on *any* treatment problem. Call your nearby Link-Belt office.

LINK-BELT

SANITARY ENGINEERING EQUIPMENT

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville (Sydney), N.S.W.; South Africa, Springs. Representatives Throughout the World.

14,054

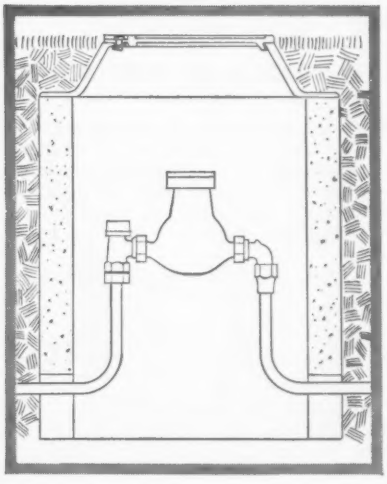
New "O" ring seal positively prevents leakage ...in all

MUELLER®

ANGLE METER STOPS

Now, all Mueller Angle Meter Stops are produced with an "O" ring seal at the top of the key. This new "O" ring, plus a generous ground key surface between the port and the top of the body, gives a dependable, positive double seal against leakage which may be caused by piping stresses on the stop body.

This improved design is typical of the intense attention to detail in research, design and engineering that becomes a part of every Mueller product produced for the water industry.



A typical setting for confined locations—a Mueller Angle Meter Stop and a Mueller Meter Coupling. No other fittings needed.

MUELLER CO.
DECATUR, ILL.

MUELLER CO. Since 1857 SERVING the Water and Gas Industries QUALITY

Factories at: Decatur, Chattanooga, Los Angeles; In Canada: Mueller, Limited, Sarnia, Ontario.

New Equipment

CONTINUED FROM PAGE 36A

switch and plugging in the crystal microphone the "Dualtronic" receiver becomes an extremely sensitive Leak Detector, useful in pinpointing known leaks or surveying an entire water system for the presence of unknown leaks.

The "Dualtronic" is furnished complete with earphones, batteries, microphone and attachments, an aluminum handle, and a carrying case.

Sealed Electrode Floatless Pump Controller

316

Chicago Pump Co., Chicago, Illinois, has developed the "sealtrode," a sealed electrode floatless pump controller.

This device, used for controlling the operation of one or more pumps, is unique in its design, in that the electrodes are completely sealed. The electrodes never become fouled, as is the case with unprotected electrodes, float and bubbler systems.

Operation is relatively simple. As the liquid level rises in the wet well, a hydrostatic pressure is exerted on the flexible bulb, which tends to squeeze the bulb, causing the displaced liquid to rise in the 2 in. support pipe towards the electrodes. The liquid level in the pipe will always equal the level of the liquid in which the controller is submerged, since the density of both liquids are equal. As the liquid within the pipe rises and falls, it makes and breaks electrical circuits with the electrodes, activating the pump starters through the controller relays.

Oil-Filled Submersible Motor For Four-Inch Wells

317

General Electric, General Purpose Motor Dept., Schenectady, N.Y., has announced the first oil-filled submersible motor ever offered as a complete unit for four-inch well applications.

Because of its design, the new submersible motor can carry significantly greater loads per rated horsepower than other type construction, according to company engineers.

Fast heat dissipation is one of the primary advantages of the oil-filled design, the engineers said. The motor's large supply of highly refined mineral oil continuously circulates around the windings with rotor movement quickly transferring internally generated heat to the cool motor shell. This efficient heat transfer is the principal reason or the motor's high load carrying ability, according to the engineers. A ½-hp unit, for example, offers a 1.60 service factor.

The oil-filled design provides inherent protection against stall and other overload conditions. The windings have unrestricted freedom to expand which helps prevent damage during heat generating conditions.

A specially designed lead seal eliminates capillary action of the lubricating oil. The lead connection—solid in the middle and molded in neoprene—avoids oil loss and lead deteriora-

to reduce installation costs and corrosion problems
. . . provide maintenance-free service, specify—
WASHINGTON ALUMINUM EQUIPMENT
FOR WATER AND SEWAGE PLANTS

1-PC. ALUMINUM GUIDES AND STOP PLATES OR SLUICE GATES
Our one piece unit means faster, more economical installation. No more riveted flat bar assemblies or machined grooves. Non-corrosive.

SAFE, NON-SKID ALUMINUM WALKWAYS
Special upset pattern provides non-skid safety. Never needs painting; resists rust and corrosion. I-Beam design gives "strength of steel" with far less weight.

For Free Product Literature, Write
WASHINGTON ALUMINUM CO., INC.
DEPT. 73, BALTIMORE 29, MARYLAND

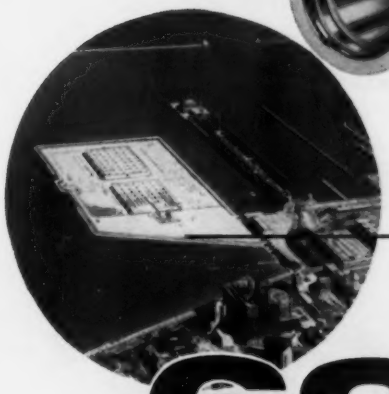
CLOW

Start of installation of Clow cast iron pipe with intermediate Bell-Tite joints in one of 192 half filter beds which compose the filter underdrain system. The Bell-Tite flare tees are first set in concrete. Note Chicago skyline in distance.

Installation of pipe and tees partially completed. Clow Bell-Tite joints permit easy and rapid assembly—an important factor especially in a job of this magnitude. Bell-Tite forms a pressure-tight joint instantly. Photo shows Neil Sullivan, pipe foreman for George D. Hardin, contractor (right), and Lewis C. Alk, Manager, Clow Technical Service Department.

CAST IRON

PIPE



In Chicago's huge filtration plant–

62 MILES OF CLOW CAST IRON PIPE

in filter underdrain system

Chicago's new Central District Filtration Plant, now under construction, will be the largest in the world. Located on a 61-acre tract of filled-in land on Chicago's lake front, it will have a normal capacity of 960 million gallons of water a day—a maximum capacity of 1680 million gallons a day. The plant was designed by Department of Public Works, City of Chicago, Bureau of Engineering, Filtration Design Division.

Over 62 miles of Clow 4" cast iron pipe—27,264 runs of pipe with 13,632 Bell-Tite® and flare tees compose the underdrain system for 192 half filter beds. Each pipe length is supplied with perforated holes with brass eyelets and has a cast iron plate welded in one end. Each Bell-Tite tee has two eyelet holes.

Easy, rapid assembly permitted by the Clow Bell-Tite joint contributes greatly to economical installation.

OUR 81st YEAR • 1878 TO 1959

JAMES B. CLOW & SONS, INC.
201-299 North Talman Avenue, Chicago 80, Illinois

Subsidiaries:

Eddy Valve Company,
Waterford, N.Y.

Iowa Valve Company,
Oskaloosa, Iowa

CLOW CAST IRON PIPE

Announcing...

the newest member in the growing family of MAGNETIC

* NOW A FULL ¾" SIZE
ROCKWELL SEALED REGISTER METER
with Powerful Magnetic Drive

Why has Rockwell invested a substantial sum in the development of another, bigger size magnetic meter? Because you asked for it! Based on your tremendous acceptance of our magnetic meter principle, there is now available to you a full ¾" size Rockwell Sealed Register meter to handle larger services. And more and bigger sizes are to come.

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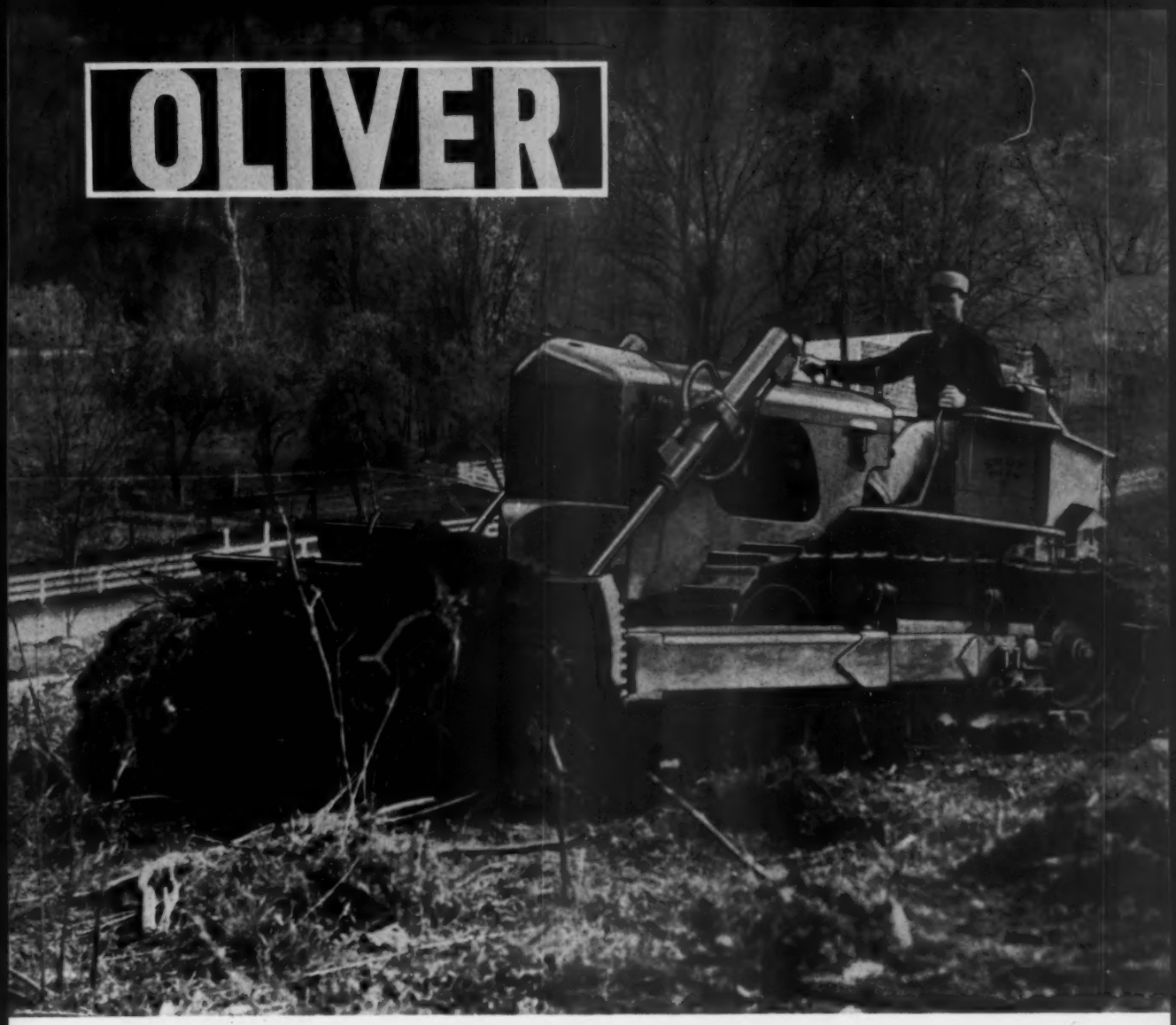

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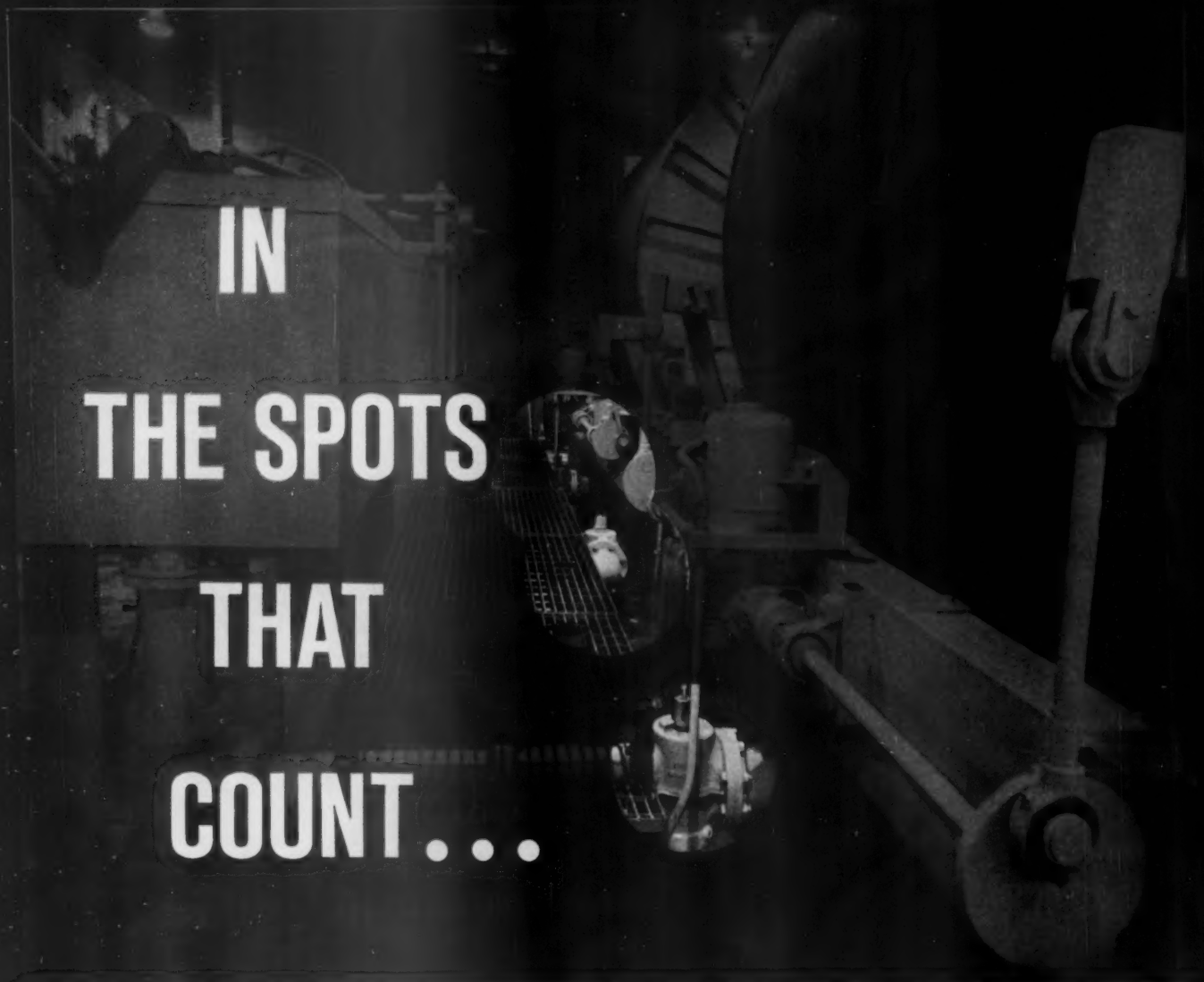

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TRIDENT WATER METERS

Vol. 106, No. 3 • March, 1959

WATER & SEWAGE WORKS

A Scranton Gillette Publication

INFILTRATION PITS at Peoria, Ill. have demonstrated a practical method for recharging ground water aquifiers. These experimental studies were part of fifty years of research and activities of . . .

The Illinois State Water Survey

by T. E. LARSON, Ph.D. and S. M. BARTELL, Illinois State Water Survey Div. Urbana, Illinois.

EDITOR'S NOTE: This month, the Illinois Section of the American Water Works Assn. commemorates its 50th anniversary. Its parent organization, the Illinois Water Supply Assn., was founded in 1909. One of the founders was the late Dr. Edward Bartow, the second director of the Illinois State Water Survey. Through the past five decades, there has been a close association between the Illinois Section and the research staff of the Water Survey. Dr. Bartow guided and stimulated the Section's early growth and was later President of AWWA. Twelve Chairman of the Illinois Section have been members of the Water Survey staff, including the present incumbent, Dr. T. E. Larson.

It seems fitting therefore, in this issue, to salute the Illinois Section of AWWA by reviewing the activities of the Illinois State Water Survey during these past fifty years. About the authors: Dr. Larson is Asst. Chief and Head of the Chemistry Section of the Illinois State Water Survey and Mrs. Bartell is Technical Editor.

■ As a Fact collecting and research organization, the Illinois State Water Survey is a unique government agency, owing to its wide scope of interests, to an extremely flexible research policy, and to close ties with a large state university. Its record of research in water, in water supply, and in sewage and industrial waste treatment demonstrates the many ways this agency has responded to changing water problems. It has been an important training ground for leaders in water supply and water research.

Research has ranged from the use of bleaching powder for sterilizing

RESEARCH effort at the Water Survey includes the development of new techniques in water analysis such as chromatographic methods of separation and identification of organic acids in trace concentrations in water.

RADAR is a new tool used in measuring rainfall and detecting severe storms. This console of high-powered sensitive radar was constructed specially for weather research and loaned to Water Survey by the Army Signal Corps.

water supplies to measuring sediment in water-supply reservoirs. It includes for example studies of the activated sludge process, removal of iron from water supplies, pollution of Lake Michigan by industrial wastes, methods of lime softening, artificial recharge of ground water, rainfall variation, and the use of radar to track severe storms.

Most of the early work at the Water Survey was concerned with the development and evaluation of testing methods to define safe water. In recent years increasing demands for domestic and industrial water have resulted in emphasis of research on water availablility. Thus, the research program of the Water Survey changes and expands according to the needs of the time.

Chemistry research, in recent years has been concerned with transmission and distribution problems and with the refinement of analytical techniques, particularly in chromatographic identification of *organic* acids, and in determining radioactivity levels in natural waters. Engineering studies have been concerned with developing and extending water supplies through studies of drought frequencies, locating potential reservoir sites, analyzing ground-water potential, recharging ground-water aquifers, and studying residential and industrial water use.

The Illinois State Water Survey began investigating the Waters of Illinois in 1895 as a consequence of the disastrous typhoid epidemic of 1893. This work, under the direction of Dr. Arthur W. Palmer, head of the Chemistry Department at the University of Illinois was concerned primarily with analyzing water. Although water was strongly suspected as the etiological factor, these studies were made before it was established through bacteriological investigation that typhoid bacteria could be transmitted by water.

Dr. Bartow, Chief, 1905-1920

When Professor Bartow became Director of the Water Survey in 1905, the annual appropriation of $3,000 was an item in the University's budget. In 1911 the Legislature made an appropriation specifically for the Water Survey, enabling it to hire engineers and establish an engineering section.

At this time, studies on problems in water softening, municipal treatment, and extent of stream pollution were undertaken at the Water Survey as well as the quantitative and qualitative inventory of the public water supplies and water resources of Illinois. Professor Bartow began his pioneering studies on the activated sludge process which contributed greatly to bringing this method of sewage treatment to a practical status in the United States.

In 1914, the Council of the American Chemical Society formed the Division of Water Sewage and Sanitation Chemistry at the request of Dr. Bartow, who served as its first chairman. Later, in 1936, he became president of the American Chemical Society.

With the enactment of the State Administrative Code in 1917, the activities at the State Water Survey were transferred from the University of Illinios to the State Department of Registration and Education, together with those of the other two State scientific research agencies, the State Natural History Survey and the State Geological Survey.

During World War I, the work of the Water Survey was virtually at a standstill with the Chief, Dr. Bartow, and most of the staff on leave to serve with the armed forces. The latter included R. E. Greenfield, H. F. Ferguson, C. C. Larson, and W. D. Hatfield.

Dr. Buswell, Chief, 1920-1955

In 1920, when Professor Bartow resigned to become head of the Chemistry Department at the State University of Iowa, the annual budget of the Water Survey was $35,000. Replacing Dr. Bartow was Dr. A. M. Buswell, appointed jointly as Chief of the Water Survey and Professor of Sanitary Chemistry for the University of Illinois, a position he held for the next thirty five years. Under his direction, the programs on sewage treatment and water treatment processes were expanded, and an explanation of the mechanism of the activated sludge process was developed. Studies were begun on the trickling filter and the application of anaerobic fermentation in treatment of sewage and industrial wastes. A summary of these studies, stressing the anaerobic production of methane, was published as

IN HYDRAULIC research, engineers are studying the most efficient design for the drop-inlet spillway. Many hundreds of these spillways are constructed each year in Illinois and about 40,000 in the United States for use in connection with water storage, flood control, and watershed protection reservoirs.

CORROSION by domestic waters and the influence of inhibitors is under study at Water Survey. This research has resulted in an empirical technique for measuring the instantaneous rate of corrosion of metals. It has shown that the rate of corrosion at normal flow appears to lessen with time owing to the formation of films or scale.

Bulletin 32 in 1939, long since out of print.

The engineering staff of the Water Survey, under G. C. Habermeyer, was meanwhile devoting its program almost entirely to the first detailed inventory of municipal ground-water supplies which appeared in 1925 as a 710-page publication. Throughout the state, the practice of making water-level measurements and well yield tests started by Habermeyer became more common as a result of this activity, and their value has been proved by the widespread use of the data by well drillers, consulting engineers, municipal officials, and private citizens.

Two supplements to the bulletin were subsequently published in 1938 and 1940, but the rapid development of ground-water supplies in the next decade required issuing a completely new inventory which appeared as a 1036-page document in 1950. One supplement to this publication was published in 1958 running to 260 pages, and a second supplement is in preparation.

Bacteriological testing of public waters in Illinois had been transferred by 1929 to the Sanitary Engineering Division of the State Department of Public Health, but analysis of water for mineral content continued to be a research and service activity of the Water Survey. Chemical research shifted to emphasis on water treatment, corrosion, and correlation of water quality with hydrology and geology.

Water Resources Work

Engineering work was expanded to include the primary responsibility in the state to cooperate with the U. S. Geological Survey on stream gaging in Illinois. Next, an intensive investigation of the water resources in the Peoria area was undertaken. Owing to drought conditions in the latter part of the 1930's and to increased industrial use of water, there had been a rapid decline in ground-water levels in this area. The Water Survey began an experimental project to determine how to recharge chlorinated Illinois River water into the over-pumped aquifer by means of recharge pits.

From this research, directed by Dr. Max Suter and partially supported by local industry, rates of recharge of approximately 25 million gallons per acre per day have been obtained, higher than at any comparable recharge project in the world. Today, owing to the outstanding success of the experiments, two privately owned recharge pits are in operation at Peoria and the Water Survey is now terminating its activity as a completed project.

Large overdraughts of ground water were occurring also in two other intensely industrialized areas of the state; East Et. Louis and greater Chicago. During World War II when water supplies were extremely critical to the war effort, the Water Survey began its program of data collection

in northeastern Illinois for the purpose of evaluating the future water resources potential. This study is the subject of a comprehensive bulletin soon to be published in cooperation with the State Geological Survey, and a significant paper interpreting the findings of this study will be presented at the Illinois Section meeting in March 1959.

Chemistry Research

The Survey's chemistry staff, during World War II, in cooperation with the University and the Chemical Warfare Service, helped develop methods to detect and remove chemical warfare agents from water.

Basic research in chemistry was not neglected during Dr. Buswell's tenure, for he had a deep interest in the chemistry of water as a substance. Work with Professor W. H. Rodebush, involving more than fifteen doctoral theses, established the NH→O linkage as the characteristic cross-linkage in proteins between peptide chains. This work lead also to important advances in our knowledge of water substance and will be reported separately at the March meeting of the Illinois Section. Studies of the anaerobic decomposition of acetic acid to form methane, and of the nitrification stage in the biochemical oxygen demand test were also undertaken and supported by grants from the National Institutes of Health.

Engineering investigations of the sedimentation of water-supply reservoirs led to urgent warnings to several communities because their reservoirs were becoming rapidly filled by sediment. These studies, including evaluations of watersheds, are conducted in cooperation with the University of Illinois, the U. S. Agricultural Research Service and Soil Conservation Service, and have been the subject of a number of significant publications.

Following the second world war, considerable attention was directed toward obtaining data on the meteorological factors related to rainfall, the basic source of water for stream flow and natural recharge of alluvial aquifers. Investigations with radar were inaugurated as a new method for estimating rainfall. Statistical studies were begun to determine frequency, duration, and rates of rainfall and local variability using dense rain gage networks and field surveys as control measures.

In 1949 the Survey accepted the responsibility for preparing specifications for purchase of chemicals and the supervision of boiler feed-water treatment at 36 state institutions. This work now involves 47 institutions and has resulted in incalculable savings in cost of chemicals, in reduced loss by shut downs due to boiler tube failures, and a considerably improved preventive maintenance of other water-using facilities. A continuing study and testing program for corrosion has been established and new treatment methods have been adopted or developed. A new method for continuously measuring steam purity has been developed which permits greatly increased savings in coal, chemicals and maintenance of turbines and other equipment at several of the institutions.

Wm. C. Ackerman, Chief 1955

Upon the retirement of Dr. Buswell in 1955, William C. Ackermann was appointed full-time Chief of the Water Survey which at that time had an annual budget of approximately $500,000. Mr. Ackermann's broad experience with the Tennessee Valley Authority and the U. S. Agricultural Research Service further widened the Survey's interests and emphasized the growing variety of sciences concerned with research in water resources.

Prior to the construction of the Water Resources Building in 1950, adjacent to the engineering campus, the Water Survey occupied quarters in the University's chemistry building. The present building contains a fine modern hydraulics laboratory with pumping facilities for 4500 gallons per minute to a constant-head tank in the penthouse serving seven overhead take-off points in the laboratory. Current research is concerned with determining the best proportions of drop-inlet spillways that have a reversible head-discharge relationship, anti-vortex controls, and the head-loss coefficients for the component parts of the spillways. The program is very important to Illinois as well as the entire United States, since 400 to 500 drop-inlet spillways are constructed annually in Illinois while many thousands are constructed throughout the United States. These spillways are used in connection with water storage, flood control, and watershed protection reservoirs.

Current chemistry research is concerned with the determination of organic acids in water by chromatographic methods that have a sensitivity to fractions of a part per million. Studies on corrosion and tuberculation by domestic waters has occupied primary interest for the past five years, supported in part by the National Institutes of Health. Water treatment has been the subject of special studies, and the peculiarities of lime softening continue to receive attention. Stabilization treatment of water remains a problem about which there is much to learn in order to control scale and corrosion, as well as slime growths and odors which develop in distribution systems.

Two new studies were recently undertaken. One is a study of atmospheric particulates as they may affect the inception of rainfall, supported by a grant from the National Science Foundation. The other concerns a comprehensive study of water temperature and heat pollution, important because the greatest present and projected use for water in Illinois is as a cooling medium. This quality factor has received very little attention previously.

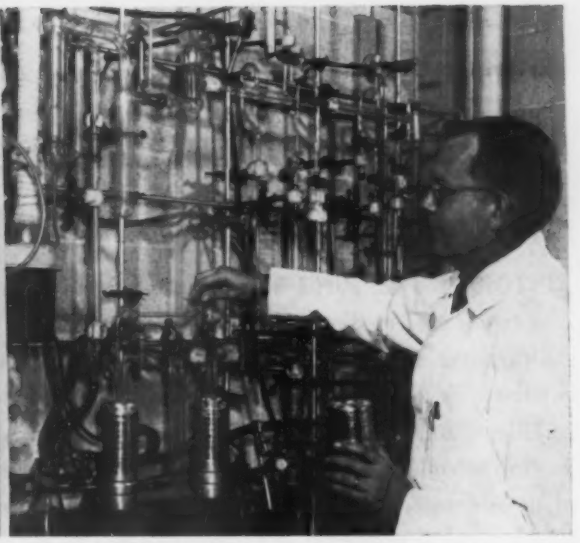
The growth of the staff of the State Water Survey is a continuing tribute to the deep interest of Illinois in its water resources and in research. At present, there are 73 professional and administrative employees and 31 student assistants.

Along with basic research, the Water Survey fulfills its statutory functions—to gather and analyze fundamental data on water resources in Illinois and to conduct research relating to the use of water for the benefit of citizens of the state. Annually, its services include approximately 2,000 water analyses and about 80 pumping tests and 500 engineering reports on the availability of ground water. The Water Survey maintains four rain-gage networks which are densely instrumented, and there are 144 stream gaging stations in Illinois which it helps sponsor as part of the program to collect data on the water resources of the state.

Board of Natural Resources

Guiding the activities of the Water Survey, the Natural History Survey, and the Geological Survey is a non-paid, non-political Board of Natural Resources and Conservation, composed of eminent scientists and

INVALUABLE engineering and mineral quality records, on the water resources of Illinois enable reference to the water supply of every municipality in the state as well as on industrial and private wells.



USED FOR determining carbon dioxide in scale samples, this specially constructed high vacuum system is also a research tool for measuring radioactive carbon dioxide as well as other gases.

three ex-officio members. As presently constituted, these members are the Director of the State Department of Registration and Education, Judge Vera M. Binks; Dean William L. Everitt of the College of Engineering, designated by the President of the University of Illinois, Dr. David Doods Henry; and the President of Southern Illinois University, Dr. Delyte W. Morris. Other members are Dr. Roged Adams, former head of the University of Illinois Chemistry Department; Robert H. Anderson, consulting engineer, Dr. Alfred E. Emerson of the University of Chicago Department of Zoology; Dr. Walter H. Newhouse of the University of Chicago Department of Geology; and Dr. Lewis H. Tiffany of Northwestern University Department of Botany. Past members of the Board of Natural Resources and Conservation have included J. W. Alvord, L. R. Howson, and W. A. Noyes.

The location of the three scientific surveys on the campus of the University of Illinois enhances the effectiveness and productivity of each. Cooperative research and exchange of facilities and staff promotes an academic research atmosphere which is seldom paralleled among government agencies.

Other Activities

The Survey staff participates, whenever possible, in short courses and training programs concerned with water treatment or water supply. It currently is working with the State Department of Public Health and the Illinois State Chamber of Commerce in supplementing the Illinois Section Water Works Advancement Program. By precedent established under Dr. Bartow's leadership, staff members take an active part in professional activities. The Survey is represented in almost every major scientific organization in the fields of chemistry, engineering, and meteorology. It is significant that the Water Survey has, at some time, cooperated with almost every other state agency in studies and problems on the state's water resources.

Over the years perhaps the greatest contribution of the Water Survey is the growing collection of factual data on water resources. This information reduces the cost of planning new projects and contributes to the effective development of the State's water resources.

Water Survey Alumni

No history of the Illinois Water Survey would be complete without a reflection on its "alumni." The late Dr. Bartow's honors have been mentioned. Dr. Buswell on retirement accepted part-time duties with the University of Florida at Gainesville. Dr. F. W. Mohlman made his career with the Metropolitan Sanitary District of Greater Chicago. Dr. W. D. Hatfield continued his career with the Decatur Sanitary District, and is now president of Federation of Sewage and Wastes Assns. C. C. Larson is manager of the Springfield Ill. Sanitary District; Dr. A. L. Elder Director of Laboratories at Argo Corn Products is now president-elect of the American Chemical Society; Dr. R. E. Greenfield recently retired as vice-president of Staley Starch Co.; Harry Schlenz, president of Pacific Flush Tank Co., has been president of the Water and Sewage Works Manufacturers' Assn.; Dr. C. S. Boruff is vice-president of Hiram Walker and Sons Distillery; Dr. George E. Symons is Editor of WATER & SEWAGE WORKS; Dr. T. E. Larson heads the Chemistry Section of the Water Survey.

W. F. Langelier, Dr. R. C. Weast, Dr. O. M. Smith, Dr. H. W. Hudson, and Dr. G. P. Edwards entered the field of higher education. M. L. Enger became Dean of the Engineering College at the University of Illinois and Dr. F. W. Tanner, head of the Department of Bacteriology at the University of Illinois.

The Illinois State Water has not only served the people of Illinois, the Ill. Sect. AWWA, and the sanitary engineering field but has also spawned these and many other "alumni" too numerous to mention, who have found their places in water resources activities of industries, universities and government agencies throughout the country.

Held at the University of Illinois Conference Center covered topics in the field of . . .

Water Works Management

Part II

EDITOR'S NOTE: Part I in the previous issue contained five of nine topics presented at this school. The reports were abstracts of the presentations made at the Water Works Management School conducted by the Bureau of Business Management of the University of Illinois and sponsored by the Illinois Section of AWWA. This was the seventh school conducted in this manner and as in the previous conferences, the theme of the school was the systematic study of management principles and techniques as a means of increasing the water works manager's skill in management. This report covers the last four topics presented during the conference: Labor relations, public information, management organization and business outlook.

Labor Relations

■ ONE SESSION of the school was a panel discussion, moderated by Edward E. Alt, of the Chicago Bridge and Iron Co., on the subject of "The Psychology and Philosophy of Labor Negotiations". Each panel member had 15 minutes to present his views and thereafter the session evolved into a question and answer period. Among the topics and ideas presented were the objectives of labor, perception and motivation as seen from different sides of the bargaining table.

Motivation from labor's point of view include maximum income, job security, good working conditions, security against old age, security against illness, security against arbitrary or discriminatory treatment, union security, and recognition as union leaders.

From management's point of view, motivation includes profit (maximum), service to customers, efficiency of operations, management's authority (not prerogatives) and flexibility, morale of employees, loyalty of employees, permanence and security of company prestige and status of management.

According to Phillip L. Garman, Professor of Labor and Industrial Relations, at the University of Illinois, who presented these comments, some of these goals are in conflict and some are consistent. Most of the conflicts revolve around how to divide the pie and management's so called prerogatives. There are no conflicts around efficiency or loyalty. As to the answer: Management should try to understand union goals and objectives and should try to get the unions to understand management's goals and objectives.

E. E. Alt

R. S. Millar

Public Information

■ PUBLIC INFORMATION—A MEANS TO WATER WORKS ADVANCEMENT, by Robert S. Millar, Manager, Board of Water Commissioners, Denver, Colo.

The breadth and depth of this subject is obviously great. It can not be covered completely in a short space of time, but as the subject is developed may we be ever mindful of the field within which we work. Water works advancement is our field. Not my water works or your water works; not Illinois water works, but *all* water works.

Every city, town and village is populated with individuals who sound off at one time or another telling you, the neighbors, their friends or the editor just how your business should be run. Are these people responsible for this abundance of knowledge, or misinformation, they have of our operations or are we to blame for having this condition so common as a part of our community life? If we are to blame, what should we do about it, what can we do about it? The answer: Public Information.

The truth and nothing but the truth is essential for any public information. Anything that is not truthful, through and through, should not be considered for public information. Untruths cannot be tolerated. The whole truth, however, in many instances would be not only wearisome and boring but could easily lead to misinterpretation, misunderstanding or even misleading and confusing the public.

Facts and Timing

Essential facts must be brought to the attention of the public at the proper time. It is not easy to release bad news at any time, but, facing up to the inevitable, and announcing what may prove to be bad news at some future date, eases the blow considerably when that day arrives and the bad news must be told.

Timing is of the essence. Here is where judgment is required. Here is where "Public Information—A Means to Water Works Advancement" strikes each one of us. Timing is not the only element which is governed by judgment. The amount of details, explained in great detail, also requires judgment.

Just about every water works operator knows the responsibility which

is his. Protection of the health against disease of epidemic proportions and protection of property against fire which could be a conflagration are two responsibilities which cannot be treated lightly. We must realize the job we have to do. Humility, someone has said, "is honest appraisal of one's self."

The first and, I believe, most important question we must ask ourselves is "Am I worthy of this trust?" We should work conscientiously to improve ourselves and those with whom we are associated. By attracting strong young people to our industry, then training them to be leaders we will accomplish that which our industry needs. No matter how we try, how clever we may believe we are, we cannot gracefully promote ourselves. We may, however, let the press, radio and TV people know about the accomplishments of our associates.

What does the public want to know about the water utilities? The public consists of such a heterogeneous mixture of people who are interested in so many different fields of activity that it can be truly said they want to know everything about our operations, *everything*! Have we tried to satisfy this broad demand? If we were to keep a record of all requests made, I believe we would find that a large number of inquiries relate to the cost of our service. To put it bluntly, "Why is my bill so high?"

The American Water Works Association has published good material on this subject. One of our big jobs is to let people know how cheap water service is. Many people never raise any questions about water service until something goes wrong. We have been providing such good service that people just take continuous good water service for granted. It is part of our job to determine what different segments of the public want to know—then tell the story in such a way that people will become more and more conscious of the low price paid for water service and more appreciative of the good service rendered.

How can the public be informed? The answer to that is really quite academic. The question which should be before us every day of every week of the year should be "What have I done, specifically what, to inform people of our accomplishments, our work, our problems?"

Check List

Here is a check list of how to handle information the public should have.

(1) News items are not the only material good newspaper men appreciate.

(2) The editorial writers are mighty grateful when a thoughtful water utility man gives them an idea or two to develop editorially.

(3) Many papers are looking for good subject matter for a special feature article. The water story has been used many times; sometimes in serial form running for several days.

(4) Radio news items, panel discussions and question and answer sessions attract a lot of attention, especially if advance notice can be given that the program is scheduled for a specific time on some station. TV has afforded many water utility men an opportunity to tell their story in a most interesting manner. Charts, diagrams and pictures may be used to good advantage on TV.

(5) Civic clubs are very happy to have you as the speaker—IF—you have something interesting to tell them. Church groups frequently have programs in which you could participate.

(6) Larger utilities have found moving pictures an excellent medium of expression. Amateur photographers have put together some creditable movies showing water utility operating and construction scenes. Some have written a commentary to be read as the movie is shown, some have sound track on the film. Some very fine colored movies with sound track and appropriate musical background have been made for larger utilities.

(7) Another medium is the brochure, sent as a separate mailing or with bills.

(8) Let us not forget that annual report. There are so many ways of making your annual report a first class carrier of all sorts of information to the public.

(9) There are other ways of getting the message to the people. When we do a good job, and perform consistantly, it is not too difficult to set the wheels in motion for the most ancient of public information media —word of mouth. If every employee is a conscientious worker, he and she *and* their families, *and* their relatives, *and* their friends can be the best source from which good news will spread so easily, so gracefully and so completely. Until the immediate family of utility employees is well informed, we will have difficulty spreading the good word to the general public.

(10) For a final thought, consider the slogan that was so impressive a few years ago—it is better than ever today—SILENT SERVICE IS NOT ENOUGH.

Organization

■ EFFECTIVE MANAGEMENT THROUGH ORGANIZATION, by Wayne A. Lemburg, Instructor, Bureau of Business Management, University of Illinois.

Organization is a process of identifying and grouping work, of finding and delegating responsibility and authority, and of establishing relationships to enable people to work most effectively together.

The problems of organization involve people, the division of labor, the source of authority, and personnel relationships or teamwork. Delegation of both responsibility and authority is important to good organization.

To Revaluate Organization

There are four steps to be taken in any attempt to revaluate an existing organization:

1. Make a list of employees, titles and duties.
2. Group employees under supervisors
3. Group supervisors levels
4. Get employees to participate, ask them to list their jobs and what they do, daily, weekly, monthly.
   a. What do they do?
   b. Names or titles they get orders or instructions from?
   c. What suggestions or advice do they give—or receive?
   d. What reports do they prepare and who gets a copy?
   e. What reports do they receive and from whom?
   f. How do they use the information in reports received?
   g. Other facets or factors in the job?

Delegation

No one should try to do everything himself; an individual is only one man and can do only so much, to do more he must assign and delegate. The difficulties in delegation stem from (a) lack of faith in subordinates and (b) lack of communication and checks on delegation.

There is, of course, an obligation on the part of the delegatee to produce on assignment.

The three elements of delegation are:

1. Work or responsibilities involved.
2. What is authority that goes with delegation.
3. What is obligation or accountability of subordinate back to manager.

Among the problems of delegation are: the manager is not relieved of responsibility for the action of others; it is often hard for the manager to find the man to whom delegation should be made; and it is often hard for a manager to give up his pet preference for ways of doing things, but all managers should remember not to try to run a one man show.

Eight steps to successful delegation:

1. Look again at subordinates
2. Take the middle road—If you look over a man's shoulder, you smother his ingenuity; but if you don't look at all some difficulty may arise; proper guidance is the middle road.
3. Measure the job for the man.
4. Tell top management, too, about subordinates' potentials.
5. Tell your man where he stands; make him understand his responsibility.
6. Make the job worthwhile; make it challenging; give sub-ordinate a chance to grow.
7. Set standards high, but not out of reach.
8. Reward the man—with money, job satisfaction, a pat on the back.

How to ease your burden—Delegate these items:

1. Responsibilities hanging over from past operations.
2. Recurring routine details.
3. Routine decision making (this should be delegated by establishing written policies.)
4. Jobs that take big chunks of time.
5. Functions you are least qualified to handle.
6. Details you don't like—find some one who does.
7. Duties that tend to over-specialize you.

When you want to develop employees, delegate these items:

1. Tasks that add to job skills or mold attitudes.
2. Tasks that provide variety.
3. Tasks that contribute to job wholeness.
4. Jobs that provide challenge.
5. A sequence of jobs of increasing difficulty.

Management Questions

Here are 13 important management questions designed to help you appraise your own application of management principles. Ask yourself each question contemplatively and answer objectively. You can thus note specific areas for self-development.

1. Am I a general manager doing an overall management job? Or am I a technical specialist in one or two phases of my business?
2. Do I have specific goals for my organization for the next five years? For the next year? If so, what are those goals?
3. Do I have plans for action that will help me attain company and personal goals? If so, are they sufficiently clear and definite to provide guidance for me and my employees?
4. Are all recurring situations that require decisions in my business covered by clear policies? Are these policies in a form, preferably written, so that they are uniformly *understood* and *applied* by every key employee in the company?
5. Have I recently analyzed the functions and activities which must be performed to meet the goals of my organization?
6. Have the functions been grouped in accordance with good organization to eliminate gaps and duplications?
7. Have all functions been assigned to appropriate personnel? Are all activities being capably performed by me and by my employees? Does each one understand thoroughly his authority and responsibility?
8. Am I providing leadership through ideas in my organization?
9. Do I make decisions on the basis of all the facts? Do I unnecessarily duck making decisions or put them off?
10. Have standards of performance been set up for every element of my business affecting profits? Do I regularly check actual results against the standard?
11. Does my system of accounts and records indicate promptly when something is wrong? Does it help me to take remedial action *where* required, *when* required?
12. Am I systematically getting the benefit of the ideas that my employees have for improving our business? Do we operate effectively as a team in my organization, with interchange of ideas up, down, and across?
13. Do I have a systematic plan for management development—for myself and my key subordinates? Is the plan working?

Business Outlook—1959

■ THE BUSINESS AND ECONOMIC OUTLOOK FOR 1959, by Robert T. Hill, Asst., Prof. of Finance, University of Illinois.

The major determinants of the 1958 recession included these factors:

1. Post war expansion of production from 1947 to 1957.
2. Pent up demand for housing.
3. Shortage in autos and other consumer durables.
4. Post war period required rehabilitation in other parts of the world to the extent of $65 billion and now there are less and less exports.
5. Financial maladjustments, particularly with respect to the increase in private indebtedness.
6. Wage and price spiral and some inequities therein; particularly the increase in number of pensioners; and the decrease in purcahsing power of the dollar from 1946 (119.6 per cent) to 1957 (82 percent) based on the 1947-49 dollar as 100 per cent.

In addition to these major determinants, there were a number of compounding and temporary factors:

1. Liquidation of inventories at high rates
2. Decline in housing construction. This was partly due to tight money policy which has now been reversed.
3. Decrease in public works.
4. Policy of credit restraint.

As to the severity of the recession—Production was down from 147 per cent to 126 per cent of the 1947-49 average. Unemployment reached 7.7 per cent. The disposable income, however, decreased only slightly. Most seriously affected were producers of capital goods, producers of durable consumer goods, metals and minerals producers, and the railway transportation industry.

What's Ahead

The business indicators reversed in April 1958 and here are the factors of strength:

1. Federal Reserve Board Index of Production is on upgrade.
2. Housing starts have shown a moderate rise since the bottom was reached in April.
3. Major consumer durables are on the rise.
4. Employment has been on the upgrade since last May.
5. Personal income has been rising since May.
6. Retail sales are up.
7. Farm income was up in the 3rd quarter and reached a plateau.
8. Total bank credit is up.
9. Municipal bond borrowing has increased.
10. Prices in metals have strengthened.
11. Resiliency in European business.

At the same time, any consideration of what's ahead must consider these factors of weakness in the present situation:

1. Continued decline of plant and equipment expenditures.
2. Decline in new construction.
3. Continued liquidation of inventory.
4. Softness in automobile production and sales.
5. Wholesale prices have not dropped.
6. Consumer credit has not bottomed out.
7. Secondary market credit has remained high; the upward market trend is due to the belief that the recession bottomed out in April.

The business recovery looks sound and on the upgrade but the pace will slow down. The government will slow it down to slow down inflation.

Liability for main breaks, rusty water damages, service extensions, Federal Government and outside rate systems are commented on in this installment of . . .

Current Events in Water Works Law

PART II of a Series

by JOHN H. MURDOCH, JR., retired Vice-president of American Water Works Co., Inc., and Chief Counsel of American Water Works Service Co., Inc., Philadelphia, Pa. Honorary Member AWWA.

EDITOR'S NOTE: In Part I of this Series (Water & Sewage Works, July, 1958), Mr. Murdoch covered current legal developments in Community taxes in system rates, Extension of facilities, Discrimination in rates, and Fluoridation.

Mr. Murdoch will welcome information, reports or advance sheets on any cases pertaining to any phase of the water works field.

As in Part I, this installment also carries section headings indicating the subject matter covered in the case or cases which follow each heading.

Water Works Agency Liability for Damages Caused by Main Breaks

ADAM HAT STORES, INC. V KANSAS CITY, MISSOURI.

This case was first tried in the Circuit Court for Jackson County, with a verdict for the defendant, Kansas City, but a new trial was granted on motion of the plaintiff, Adam Hat Stores. The city appealed this new trial order to the Kansas City Court of Appeals. That court affirmed the lower court's order. See 307 S.W. 2d 36. The City then appealed this decision to the Supreme Court of Missouri in that Court's April Session, 1958, when it had the number, 46,704. In the fall of 1958 the Supreme Court of Missouri affirmed the order of the trial court and the cause was remanded for the new trial. The court divided four to two.

A water main laid four feet under a city street broke fifty-three years after it was laid and escaping water flooded a storage basement of the hat store and damaged merchandise there stored. Suit was brought and at the trial the city witnesses did not advance any evidence showing the cause of the break and testified that the cause was unknown. Two city employees were at the site very shortly after the break, but were not called as witnesses. Counsel for Adam Hat Stores was not permitted to comment on the city's failure to call these employees. The court submitted the case to the jury on the ground that the doctrine of res ipsa loquitur raised such an inference of negligence as to justify such submision. The jury returned a verdict in favor of the City. On motion of the Hat Stores, the judge granted a new trial because of his earlier refusal to allow the Hat Store's counsel to comment on the City's failure to call the two city employees as witnesses. The City appealed this new trial order on two grounds: First, that the prior ruling regarding counsel's comments was correct and, second, that the case should not have been submitted to the jury because the doctrine of res ipsa loquitur did not properly apply. The courts, including the Supreme Court of Missouri, have now held the city wrong on both points. Unless there is a settlement, a new trial must be had, with, of course, the possibility that a second jury may agree with the earlier one and find for the city.

As the Adams Hat case has developed in the courts the chief point of emphasis has been the application of the doctrine of res ipsa loquitur. Because of this emphasis a short explanation of the doctrine is offered here. The majority opinion of the Missouri Supreme Court in the instant case states that the Missouri application of the "rule of res ipsa facta" has "been well stated" in the opinion of the Kansas City Court of appeals. That courts statements concerning the rule began on page 38 of 307 SW 2d. Omitting the citations of authorities, the following quotations set out the statement of the Missouri rule.

"The res ipsa loquiur doctrine has been defined as meaning that negligence can be proved by circumstantial evidence, and that certain circumstances, as to the character of the accident are sufficient to take the case to the jury. — — — The basis of the allowable inference of negligence is the doctrine of probabilities. — — — Our Supreme Court — — declared the following three conditions necessary before [the] doctrine may be applied.

"(a) the occurence resulting in the injury was such as does not ordinarily happen if those in charge used due care; (b) the instrumentalitus involved were under the management and control of the defendant; (c) and the defendant possesses superior knowledge or means of information as to the cause of the occurrence."

(From page 39) "in a res ipsa loquitur case, the plaintiff has the burden of proving each factual ingredient necessary for a prima facie case. — — This does not mean

that plaintiff is required to present evidence overthrowing every reasonable theory of nonliability on the part of defendant. — — — Nor is it requisite in order to invoke the doctrine that plaintiff's case be such as to exclude every hypothesis but that of defendant's negligence. — — — "the attendant facts must raise a reasonable inference of a defendant's negligence (but they need not exclude every other inference). — — Or as sometimes stated, the proof should establish the desired inference with such certainty as to cause it to be the more reasonable and probable of the conclusions to be drawn. — — The doctrine cannot be invoked where the existence of negligence is wholly a matter of conjecture and the circumstances from which negligence may be inferred are not proved but must themselves be presumed."

With the law existing as stated, the trial court, the Kansas City Court of Appeal and a majority of the members of the Supreme Court of Missouri appear to have decided that a break in a fifty-three year old pipe line laid four feet under a Kansas City, Missouri, city street, would not ordinarily happen if those in charge used due care.

Judge Storckman of the Missouri Supreme Court in his dissenting opinion in the case cites authorities for the following propositions. "— — the circumstances in evidence must warrant an inference of negligence. — — — All the facts connected with each particular case must be consulted, and from them the court must be able to take judicial notice, as a matter of common knowledge and experience, that the accident prima facie could not have occurred but for negligence on the part of the defendant." Later in his dissent he wrote:

"— — I see nothing that this defendant did that might reasonably be said to have caused the break or anything it failed to do which if done would have prevented it. On the other hand, as the result of common knowledge and experience, it occurs to me that the break probably occurred as the result of independent causes, such as soil settlement or the pounding of heavy traffic on a busy city street, over which the defendant has no control and for which it could not be held liable on the theory of negligence."

No matter what the outcome of this particular case, the law of Missouri now is that when a water main breaks and causes damage and the cause of the break is unknown and even unknowable, there is such an inference of negligence on the part of the water works as will justify submission of a damage claim to a jury.

What lessons can be learned from this unfortunate case?

Since the city lost the effect of a jury decision in its favor because counsel for the plaintiff was not permitted to comment unfavorably on the failure by the city to call as witnesses city employees who were early on the scene of the accident, perhaps, it would be good tactics for a water works to put in evidence all that it knows of the circumstances.

Also, water works should offer testimony concerning all the independent causes which do cause line breaks in spite of all that the water works can do. The proof should be that line breaks do often happen even though those in charge use all due care.

There is a risk of harm to others whom water under pressure is piped through city streets but there is no known way to distribute water under pressure to consumers except through such pipes. Our communities require such service and the social benefits of the service for outweigh the disadvantages of risk of harm. (See page 47 of Notes on Water Works Law—Murdoch).

Thanks are here extended to W. Victor Weir of the St. Louis County Water Company and his associates for calling attention to this case and for sending copies of the opinions.

Water Works Agency Liability for Damages Caused by Rusty Water

LIFMAN BROS., INC. V. AUGUSTA WATER DISTRICT in the Kennebec County Superior Court (Maine).

This case was called to the attention of this writer by the Maine Water Utilities Association, Sidney S. Anthony, Editor. On page 32 and following pages of the association's May 1958 journal, there is a very complete statement of the case written by Richard B. Sanborn, Esq. Grateful acknowledgment is here made of the courtesy of calling this important case to attention and of permission to quote him from Mr. Sanborn's article.

Mr. Sanborn states in his article that on May 22, 1956 a chicken processing plant in Augusta found large quantities of rusty water pouring from nozzles in its production lines. As soon as possible the water supply was cut off but a considerable number of chickens were damaged by the contaminated water. The government inspector ruled that they could not be re-washed in such manner as to be suitable for sale and they were condemned. Suit was brought for damages.

The claim was made on three basic grounds. The first was negligence in furnishing unsatisfactory water. The second was liability under the Maine Food Law for furnishing food, namely, water, which was contaminated. The third was for liability under the Uniform Sales Act in that there was an implied warranty that any water furnished would be clean. The claim of negligence was based on the claim that the District made repairs to its mains improperly, that if failed to notify the plaintiff at the time of repair work so that precautions could be taken, and that it did not do such repair work at night when the chicken processing plant was closed to operations.

Justice Marden, as Referee of the Kennebec County District Court, rendered a decision absolving the District from liability. No appeal was taken.

It was held that a water works is not an insurer that the water delivered will always be perfectly clean. Liability only attaches if the water works be guilty of negligence. There was no evidence of work being done by the District likely to stir up the water. Nor was there proof that the rust came from the mains rather than from interior piping, which was in part galvanized and might have produced the rust. The Court ruled, therefore, that the doctrine of res ipsa loquitur could not be applied and that the plaintiff had the burden of proving the rust came from the mains.

The chicken processing plant was also ruled guilty of contributory negligence. It had previously had one or more experiences with rusty water and was thereby warned of the possibility of a recurrence. If absolutely clear water was essential at all times it had the duty of providing its own filter system. Because of this finding of contributory negligence the court did not decide

whether water was a food or whether rusty water was contaminated water under the Food Law.

On the implied warranty issue the Court held that there was no liability because a water works has merely the responsibility to furnish reasonably clean water and that perfection cannot be guaranteed.

Mr. Sanborn, in his comments on the case, states that the District found its "products insurance" excluded protection where damages occur to products of a manufacturing plant and, while it had regulations providing that it would be liable for damages only in cases of its own negligence, there was no proof that the plaintiff ever received a copy of those regulations. These are points which water works managers might keep in mind.

Negotiated as Distinguished from Commission Approved Rates, for Service to Federal Government

UNITED STATES OF AMERICA V. PENNSYLVANIA PUBLIC UTILITY COMMISSION. Before the Pennsylvania Supreme Court. 24 PUR 3d 473. Appealed from Pa. Superior Court, 21 PUR 3d 81; 135A 2d 93; 184 Pa. Superior Court 380.

This is a railroad case but the reasoning appears equally applicable to any regulated utility service. The court holds that the Public Service Commission has no power to prevent the United States from getting the benefit of negotiated rates even though those rates be lower than those contained in legally filed tariffs.

Service Extensions

Re ELIZABETHTOWN WATER COMPANY, CONSOLIDATED-NEW JERSEY. BOARD OF PUBLIC UTILITY COMMISSIONERS, Aug. 7, 1958, 24 PUR 3d 496.

Since 1923 water companies in New Jersey have made free extensions on refunds of customer's advances at the rate of 3½ times minimum charge for one year for each customer initially connected directly to the extension. This practice was in conformity with rules suggested by the Commission. Recently the New Jersey courts ruled that each application for extension must be considered on its own circumstances and that a blanket rule such as the one suggested in 1923 by the Commission was an unlawful delegation of Commission authority. The case on which the courts ruled was one involving individual customers. Elizabethtown filed a rule following the 1923 suggestion, applicable to real estate developers. The Commission now rules that this is unlawful and that such a blanket rule is unreasonable. The Commission reached this decision on the basis of the court opinion reported in 24 PUR 3d 343.

McMULLIN V. UTAH PUBLIC SERVICE COMMISSION. Before Utah Supreme Court. Decision February 3, 1958, 320 P 2d 1107; 23 PUR 3d 79.

McMullin opened a real estate subdivision adjacent to the service area of a water company. That service area was not well defined but the Commission decided the new subdivision was outside of it. The Commission also found that the water company did not have sufficient supply to give adequate service to its service area plus the new subdivision. Under these conditions the Commission denied the petition of Mr. McMullin to compel the water company to extend service. On appeal by McMullen, the Utah Supreme Court affirmed the Commission order. A few sentences from the Court's opinion are of general interest.

(Page 81 of 23 PUR 3d) "At the time of hearing the company had in excess of 1,000 customers who used the entire 1.5 cfs of water and more during the hot weather. — — — there is also testimony that the service area to which the water company is already committed to serve has a potential of up to 6,000 additional homes. There is thus justification for apprehension, as indicated by the commission, that the inclusion of new territory in the water company's service area would imperil adequate and proper service within the locality now covered and that prudent management of the water which the company has dedicated to culinary uses would dictate no further extension lest the available supply be spread so thin that there would not be satisfactory service for anyone."

"— — — The fact that population is constantly increasing while water resources remain static obviously poses problems of steadily increasing intensity. The view here taken by the commission is quite consistent with its purpose and responsibility of supervising the use of culinary water so that it will be neither wasted nor misused and that it will be so allocated that there will be satisfactory, adequate, and continuous service to the portion of the public the utility is undertaking to serve."

CITY OF WAUWATOSA V. CITY OF MILWAUKEE. Before Wisconsin Public Service Commission; No. 2-U-4719. Decided April 2, 1958. Rehearing denied May 2, 1958.

When a city plant supplies a number of contiguous municipal utilities it thereby holds itself out to serve all similarly situated communities. Refusal to serve any one of such communities would constitute unlawful discrimination. The Public Service Commission may require the city to construct increased plant capacity to insure adequate permanent resale service to the contiguous community.

Municipal Water System Rate Base for Service Outside Municipal Limits—Federal Grants in Aid of Construction

CITY OF COVINGTON V. KENTUCKY PUBLIC SERVICE COMMISSION. Before Kentucky Court of Appeals; decided February 28, 1958, modified on rehearing denial June 6, 1958; 24 PUR 3d 290.

Rates for water service to "outside consumers" are subject to regulation by the Kentucky Public Service Commission. The Commission entered an order fixing a rate base "for so much of the water plant as was apportionable to outside consumers" and establishing a schedule of rates calculated to produce a fair return on the rate base. On appeals to the courts the order was affirmed with the exception of one point.

The exception was that a P.W.A. grant to the city for aid in water plant construction should be included in rate base to the extent that it was properly allocated to service outside the city.

It is held by the Commission and the court that a city is entitled to a fair reurn on invesment allocated to service outside, rather than "cash needs," as would be proper for inside service. Customers outside are not obligated to pay either principal or interest of city general obligation bonds, over and above the fair return on investment.

Proper selection and installation are the main factors concerning . . .

Centrifugal Pumps

by PAUL C. ZIEMKE, Clinton, Tenn.

RESUME: The centrifugal pump is simple, requires little space and the attendance amounts to but a small portion of a maintenance man's time. It can be used for sand and slimes, and most of the aggregates or minerals in production operations. In the field of water and sewage treatment the centrifugal pump with gravity feed and properly designed discharge line is a dependable and flexible unit and it operates at a reasonable cost.

■ CENTRIFUGAL PUMPS are those in which fluid is given an initial velocity and pressure by a rotating impeller. The action is not positive since the amount of fluid discharged is not necessarily proportional to the impeller displacement. The absence of valves and the packed pistons common to displacement pumps, makes them well adapted to handling dirty or gritty water. The fact that the moving parts have a rotary motion in place of a reciprocating motion makes them quite suitable for electric motor drives, either directly from the motor shaft in most instances, or by pulley and belt if the pump and motor speeds do not coincide. Compactness makes the pump well suited for confined areas.

Description

Centrifugals consist of: (1) A rotary impeller which draws in the fluid at its center and (2) a stationary casing in which the fluid is thrown from the ends of the impeller and is guided into the discharge outlet. An increase in the peripheral speed of the impeller increases the pump's effectiveness either through an increase in the pressure, or an increase in rate of discharge. The casing may be either cylindrical or concentric with an impeller of spiral form which may be plain or fitted with diffusion vanes. The pump may have any number of impellers. The shape of the impeller and the casing, and the number of impellers or stages determine the efficiency of the pump.

Advantages vs. Disadvantages

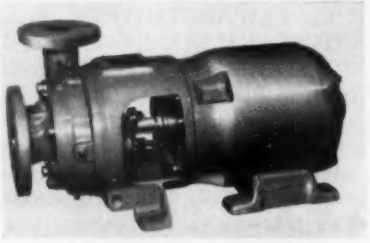
Some of the advantages of the centrifugal pump as compared to the plunger type are: (1) low first cost, (2) compactness, (3) absence of valves and pistons, (4) low rate of depreciation, (5) uniform pressure and flow of liquid, (6) simplicity of design and ease of operation, (7) freedom from shock injury through water hammer, (8) high rotating speed permitting direct connection to electric motors and steam turbines, (9) ability to handle dirty water, (10) pressures unable to increase beyond predetermined working values, and (11) ease of repair.

Some disadvantages are: (1) efficiency not as high as the best types of plunger pumps, (2) cannot be driven by slow speed engine, when high lifts are desired, and (3) the rate of flow cannot be regulated readily for wide ranges in duty.

Features of the Motorpump

The motorpump is a compact unit that requires a minimum of mounting space with the motor and pump mounted on a universal base. The impeller is precision balanced for maximum performance which assures good mechanical balance, and smooth, vibrationless operation. The hydraulic balance reduces the thrust and places suction rather than discharge pressure on the stuffing box. Its deep stuffing box provides space for up to five rings of packing and a sealing gland. The bronze needle valve in the stuffing box sealing allows pump discharge pressure to be adjusted for proper sealing and lubrication. In units where mechanical seals are used in place of packing, the needle valve is replaced with a throttling orifice.

The single unit pump and motor shaft are usually made of stainless steel to improve their resistance to wear and the effects of acids and alkalis. The hard shaft is durable but the machine has replaceable sleeves to compensate for eventual wear. Packing is provided between the sleeve and the impeller to prevent leaking under the shaft sleeve and subsequent corrosion at that point. The two piece packing gland of the split type is easily removed from the shaft, giving space for repacking as required. Ball bearings are provided for radial and thrust capacity. A cartridge type housing seals out the dust and dirt. A unique feature is a liquid flinger on the shaft that protects the motor bearings from contamination. The removable suction nozzle allows easy access to the impeller without disturbing the discharge piping. Replaceable casing rings seal the impellers.



THE MOTORPUMP is a compact unit requiring little space—An Ingersoll-Rand Co. pump.

The Volute Pump

The open-runner single inlet volute is the most commonly used for lifts up to 50 ft. Multistage pumps are employed for elevating liquids up to 80 ft. Pressure to lift the fluid is obtained by the conversion of a large part of the velocity head, produced by the impeller, to pressure head. The direction of the motion of the fluid at the instant it leaves the impeller is the resultant of motions tangential to the periphery of the impeller blades. The volute chamber is designed so that the cross-sectional area increases gradually toward the discharge pipe, and the change from velocity head to pressure head thus takes place with the smallest possible loss. The total head which the pump must equal, is the sum of the differ-

ence in head between the intake and the discharge levels, plus the velocity head required to give motion to the fluid, plus losses in the pump and losses due to friction in the pipe lines. The shape and curvature of the impeller blades are important considerations in design for any given service.

Impellers may have four, six or more blades. The shell may enclose replacement type liners or the shell itself may be designed to take the wear. Impellers and liners are generally made of cast iron or manganese steel; however, rubber liners and rubber cased impellers are standard features in many modern pumps designed for abrasive pulps.

The greatest wear is on the impellers and liners; it varies with the size density and abrasiveness of the entrained particles. Coarse material causes greater wear than fine, and very thick pulp cause less wear than those of intermediate densities.

Rubber lined pumps of different types and sizes are effective in a large group of installations. Pumps operated at the highest mechanical efficiency usually require the largest expense in replacement of linings. Wear is greatly accelerated by overloading and by excessive speeds. Experience has shown that deterioration of a rubber covered impeller is much more rapid than that of the case linings. Wear on uncovered white iron impellers is diminished by rubber linings of the case, probably due to the better stream lined flow obtainable in the absence of pits. The development of pits on metal liners is inevitable.

Pump's Metal Parts

The pumps are usually furnished in a variety of materials to suit the customers needs, depending on the liquid handled. Some of the special makes employ ni-resist, carbon steel, nodular iron and many types of stainless steel.

A few of the special types are listed here:

Pump Part	Liquid Pumped: Water	Mild Caustics — Hydrocarbons	Juices — mild acids
Chassis	Regular or bronze fitted cast iron	All iron	All bronze
Impeller	Bronze	Cast iron	Bronze
Casing	Cast Iron	Cast iron	Bronze
Casing rings	Bronze	Cast iron	Bronze
Shaft sleeve	Bronze	Mild steel	Bronze

Pump Installation

Specific Speeds

Specific speed is an index employed in determining a desirable rotative speed. Such desirable rotative speed may be 3500 rpm for a small capacity pump with low suction lift or it may be only 300 rpm for a larger pump with high suction lift.

Specific speed gives one a picture of the relationship between head, rotative speed and the capacity in gpm of any pump.

The formula is as follows:

$$\text{Specific speed} = \frac{\text{rpm}\sqrt{\text{gpm}}}{\text{H } ¾}$$

In as much as the application specifies the capacity in gpm and the head in feet, the engineer will make the above calculation in order to select a rpm which will give the desired specific speed.

If the suction is high, it is necessary to operate at a rpm which will give a low specific speed. Experience has shown that the high specific speeds may cause serious cavitation in pumps operating with suction lifts or even with small positive heads on the suction. Putting it another way, pumps with high specific speeds should be used only where the application is carefully engineered and maintained.

The efficiency of centrifugal pumps increases up to 2000 specific speed. Above this figure, little or no improvement in efficiency occurs. As the specific speeds rise above 6000 to 8000 there is a tendency toward reduction in efficiency which can only be offset by the most skillful and careful design.

In this connection, the design point of the pump is the point selected for the specific speed calculation.

The appropriate rough and ready classification of pumps is:

1. Low specific speed pumps.
2. Medium specific speed pumps.
3. Mixed flow pumps
4. Axial flow pumps.
5. Axial flow pumps of high specific speed.

Suction Lifts

The table indicates the approximate theoretical maximum suction lift in feet at 60°F for various altitudes and fluid densities; actual lifts ordinarily will not exceed one half the theoretical. Increase in temperature reduces the maximum suction lift, owing to the increased liberation of vapor at higher temperatures. Very hot liquids should be fed by gravity to the suction line.

Effects of Temperature on Suction Lifts

°F	Approx. Theoretical Max. Suction Lift at Sea Level
60	34
80	33
100	32
120	30
140	27
160	23
180	26
200	08

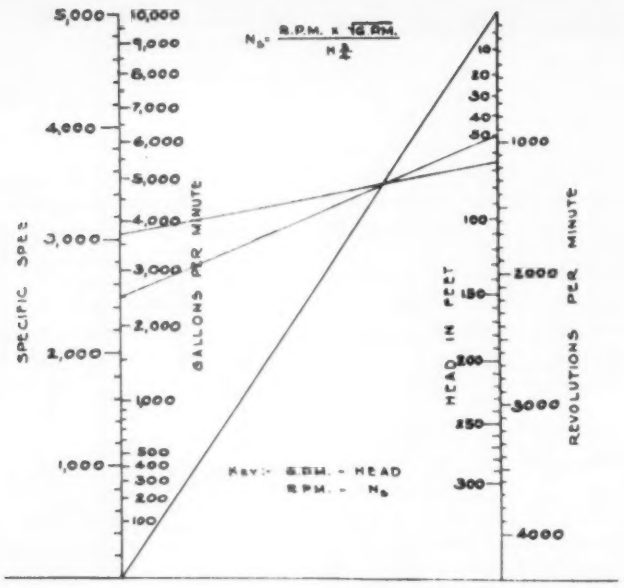
Pipe Layout

The pipe layout should be carefully planned; a level run may cause clogging, bends should be as few as possible and of long radius; valves should not be placed in pulp lines since closing may cause solid material to pack so that the line will not clear again when the valve is opened; stopping the pump may cause similar trouble. Provision of a by-pass to be opened just before shutting down the pump will maintain a clear line; shutting off supply pulp and substituting clear water before shutting down is also recommended. The by-pass is the best arrangement, as the pipes can be drained if the pump stops accidentally.

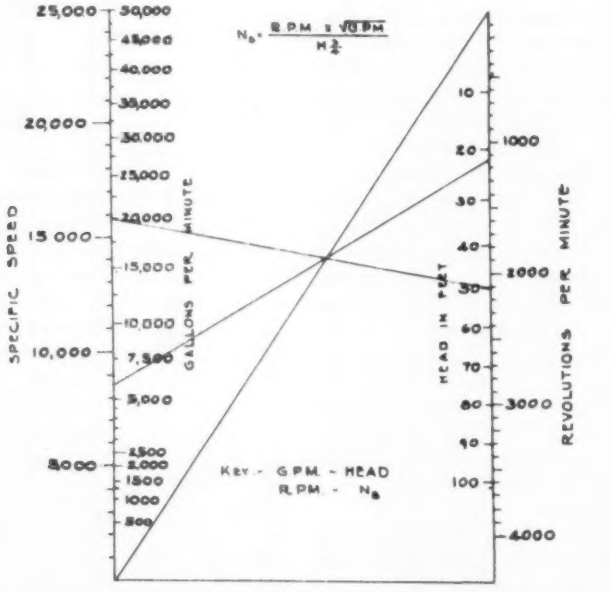
Velocities of 350 fpm in discharge pipes and 200 fpm in the suction line will, in general, prove satisfactory.

Suction Line

Keep the suction line free of air pockets; use a suction line at least one size larger than the pump nozzle. Arrange the length and size of suction so that the maximum suction lift, including all losses, will never exceed 20 ft of water (17.5 inches of mercury). When the pump operates with



EXAMPLE: 2500 G.P.M. at 50 Foot Head at 1150 R.P.M. $N_s = 3060$.



EXAMPLE: 20,000 G.P.M. at 50 Foot Head at 1150 R.P.M. $N_s = 8650$.

CHARTS for determination of specific speeds.

a suction lift, the suction pipe should slope upward to the pump nozzle and downward toward the source of supply. Horizontal suction lines should have a gradual rise. Do not install any part or section of a suction higher than the pump suction nozzle.

Whenever another pipe or other obstruction requires bending from the natural slope, run the suction under the obstruction rather than over it. The pipe reducers at the pump suction nozzle should be of the eccentric type to prevent air pockets in the suction line. A gate-valve should not be used in the suction line under the suction lift; however, when used, air pockets can be eliminated by turning the valve stem in a horizontal or bottom direction. The end of the suction pipe should be at least 3 ft below the minimum pumping level of the liquid pumped. The pump must never be throttled on the suction side. After the installation check the line with water or pressure to make sure there are no leaks.

Foot Valve

The foot valve should not be installed in the suction if other means of priming are feasible. If the foot valve is deemed necessary it must be installed at the extremity of the suction and preferably below the mean water level. The foot valve should be of the wing type and should have a passage of at least 150 per cent of the suction area. Any small piece of debris caught in the foot valve will cause the pump casing to drain during idle periods, and then it will not pump again.

When a foot valve is used to prime a pump having an automatic start and stop control, by-pass line of $\frac{1}{8}$ inch pipe should be installed around the check valve to the suction. A safety device must be installed to prevent the pump being started if not fully primed. For manually operated pumps a control valve in the by-pass will prove convenient to prime the pump and the suction before starting up.

The Strainer

To keep the pump from being clogged with foreign matter it is essential that a strainer be installed in the suction. To keep the pump from "starving" when partial blockade occurs it is required to have the strainer four times the area of the suction pipe. Bad conditions may require the installation of trash racks that can be cleaned at intervals.

The Discharge Pipe

Install a check valve and a gate valve in the discharge line. No manufacturer will make replacements at his expense if the pump is run without a check valve. When the pump is stopped, the check valve will protect the pump against excessive pressure and backward flow of the liquid in the discharge pipe. The check valve should be installed between the gate valve and the pump in order to permit inspection. The gate valve is frequently useful in starting and priming the pump.

Pump Priming

Liquid must fill all parts of the centrifugal pump before it can be started.

Maximum Suction Lift in Ft.

Altitude above sea level, ft	Specific Gravity of Fluid. 1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7
Sea level	34	31	28	26	24	23	21	20
1,000	33	30	27	25	23	22	21	10
2,000	32	29	26	24	22	21	20	18
3,000	31	28	25	23	22	20	19	18
4,000	29	27	24	23	21	20	18	17
5,000	28	26	23	22	20	19	18	17
6,000	27	25	22	21	19	18	17	16
7,000	26	24	21	20	19	17	16	15
8,000	25	23	21	19	18	16	16	15
9,000	24	22	20	18	17	16	16	14
10,000	23	21	19	18	17	16	15	14

Many parts in the pump's construction are completely dependent on the flow of liquid to furnish the lubricating medium. To attempt to run a pump dry can develop disastrous results. There are five methods for priming pumps: (1) submerged suction, (2) ejector, (3) vacuum pump, (4) foot valve, and (5) sump service (automatic priming). Pumps, which have been installed so that their center-line is below the level of the liquid to be raised, will prime themselves automatically when the vent in the top of the casing is opened to release the entrapped air. A float controlled switch installed in the suction tank or sump will stop the unit in the event of liquid level failure. This will protect the pump from running dry and ruining the water lubricated bearings. Protective features are provided for automatic starting and stopping with provisions made to stall a pump if priming is not effected prior to start-up.

Pumps operating under a suction lift may be primed by means of an ejector or exhauster operated by compressed air, steam or water. The ejector must be installed at the highest point of the casing where a suitable tap is provided for that purpose. The ejector removes the air from the pump casing and suction line, and allows the water to rise to the level of the casing.

To prime the pump with an air or steam ejector or exhauster, close the gate valve in the discharge line near the pump (if the discharge pipe is full of liquid it is unnecessary to close the valve, because the check valve will be water sealed). Turn on the ejector. As soon as the waste pipe of the ejector throws liquid continuously, the pump may be started. If a steady stream is not obtained soon after the pump starts, the pump is not primed properly and should be stopped and the priming repeated.

Foot Valve Primers

With a foot valve installed and no liquid in the discharge, close the discharge valve and pour liquid by means of a funnel through the vent in the top of the casing until casing and suction line are completely filled. If a water supply under pressure is at hand connect it to the suction pipe and open the air cock on the casing to release the air.

Where there is liquid in the discharge pipe, the pump and suction line may be primed by means of a by-pass piped from the discharge pipe beyond the check and gate valve to the suction line. Always make sure that the pump is primed because the foot valve may develop a leak at any time.

Pump Protection

Pump Operation

Never run the pump in reverse. Check the arrow mark cast in the frame and run the motor with temporary connections to check for rotation and see that the motor name plate data checks with the speed indicated for the pump. Never use a series type direct current motor which will run wild when the pump is unloaded. Also when using a compound motor make sure the field is properly placed in the circuit and energized accordingly.

In starting pumps for the first time, and always when there is no pressure in the discharge line, close the gate valve in the discharge line. If the pump has a suction lift and the stuffing box is internally sealed, close the needle valve controlling the liquid seal. If the stuffing box is externally sealed, open the valve to allow the liquid to flow in the box.

Prime the pump by any one of the several means described earlier. If the pump is to handle hot water, open the suction valve to allow a slight flow of liquid into the pump casing and leave the vent open to allow overflow of the liquid. This will allow the pump to heat slowly and evenly. Open the suction valve wide before starting. Rotate the pump by hand through at least one complete revolution to see that all parts are free. It is possible that pipe strains, extreme rough handling, etc. may bring about contact of the rings causing binding. If binding is evidenced, the piping should be realigned and all strains eliminated. The bolts holding the suction pipe, casing and etc. should be loosened until the binding is freed.

After the pump is fully primed, close the starter switch in accordance with the instructions offered by the electrical manufacturer. Permit the pump to gain the required speed and let it run for a few minutes. Then check for abnormal temperatures of motor and pump bearings.

Never operate a pump for an extended period with the discharge line closed, unless the vent valve is open to allow a circulation of liquid to prevent heating and probable seizing of the bearings. Never throttle the pump on the suction side; rather reduce the output by partially closing the discharge gate valve.

Adjust the valve controlling the sealing or cooling liquid in the stuffing box so that there is slight leakage to keep the packing well lubricated. It is important to keep the gland as loose as possible without leaking since overtightness merely adds up electric meter bills and may burn out the motor.

When the sump is exposed to freezing temperatures care should be taken to prevent any liquid freezing within the pump when it is shut down. When the pump is idle, and there is a possibility of freezing, the pump should be drained by removing the pipe plugs in the bottom of the casing.

Packing and Stuffing Box

The packing in general should be the softest available on the market and adapted to the service on which

the pump is working. The types are: For general service, soft asbestos with soap lubricant. For liquids which must not be contaminated, soft asbestos with a lubricant such as petrolatum. For petroleum products, solvents and, etc., soft plastic packing in ring form with addition of insoluble grease seal.

The packing in the stuffing box is divided into two parts: a lantern gland is used to guide liquid around the shaft to either seal off the air leakage along the shaft to the impeller inlet, or for circulation of liquid to cool the packing.

When the lantern gland is connected to the discharge side of the pump, as by a cored passage within the pump casing, the stuffing box is said to have an "internal seal." When the lantern is connected to the source of supply other than the pump discharge, the box is said to have an "external seal."

Pumps handling hot liquids are usually sealed with clear, cool liquid for cooling the packing.

Pumps handling dirty, gritty, or corrosive liquids should be externally sealed with clean, noncorrosive liquid to prevent rapid corrosion and scoring of the shaft sleeve.

When adjusting the stuffing box gland, tighten the nuts evenly while the pump is running. Always allow a slight leak to lubricate the packing and the shaft sleeve. A gland pulled up too tight will cause excessive wear on the packing. A gland properly tightened should be freely rotated by hand.

Metallic packing should be used only with hardened shafts and sleeves and when there is no grit or sediment present in the liquid. It is usually more satisfactory than soft packing for severe service. Particular attention must be given to metallic packing to prevent excessive wear between packing and the shaft sleeve.

Proper Lubrication

The life of any bearing is dependent on the care the bearing is given. First consideration is the selection of the proper grade of lubricant and that it is kept free of all contaminants while in storage or application. Additives such as graphite, resin and other foreign materials are warned against. DON'T OVER LUBRICATE. Excessive use of the grease gun readily do more harm than good since often grease seals are ruptured, grease forced where not desired, and overgreased bearings forced to run hot because of the congestion around the fittings and the relief plug.

Wipe clean the pressure gun fitting and the pressure fitting. The fitting will usually be found at the top of the end shield and the relief plug is at the bottom plug in the ballbearing cup, and adjacent to the shaft. On the face type end shield a relief plug opening is also provided at the bottom of the end shield, but is preferable to use the relief plug in the bearing cup because it opens directly into the grease chamber. The method: Remove the relief from the cup. With a sharp instrument remove any obstruction in the relief hole. Add grease with the hand gun with the pump running until grease is forced through the relief hole. When clean, new grease appears stop pumping the gun and permit the pump to run until all surplus grease has been expended.

Grease Specifications

The purchasing department should never shop for "bargains" but should be guided by the standards set up by the American Society for Testing Materials.

1. The grease must be sodium soap grease, carrying not less than 82 per cent of high grade, filtered mineral oil of Saybolt viscosity of not less than 150 seconds at 100°F.

2. The grease must not separate on standing or when heated below the melting point.

3. It must not gum or become sticky.

4. It must not decompose or harden.

5. It must not corrode any type of ball-bearing.

6. It must be free from resin, mineral salts, abrasive such as sand, free lime, etc.

7. It must have a melting point of not less than 300°F and a penetration at 77°F to 275 to 330.

Oil Lubrication Specifications

For all pumps having lubrication by oil, the following specifications are suggested for the procurement of the proper grade of oil.

1. The oil must be refined petroleum oil, free from all acids, alkalies, soaps, thickeners, or other non-petroleum substances which tend to make it emulsify, gum or "liver-up."

2. The oil shall conform to the following standard physical characteristics based on tests by the ASTM.

	Naphta Base	*Paraffin Base*
Flash Point	330°F Min.	360°F Min.
Saybolt Visc. at 100°F	150 Min. 200 Max. Sec.	150 Min. 185 Max. Sec.
Pour Point	5°F Max.	36°F Max.
Steam Emulsion Value	75 Sec. Max.	75 Sec. Max.

Annual Checks

Perhaps one of the most severe duties imposed on a centrifugal pump is that of boiler feed service where a look inside once a year is suggested to learn if wear, fractures, poor circulation, cavitation or over-heating are causing bad performance. In the stuffing box look for wear from the packing or corrosion set up by the material handled. Check for corrosion set up by the material at the ends of the sleeves. See that the water finger ring is tight on the shaft, seal with paste if needed. On the small type bearing insert four or five turns of wire solder, then fasten down the bearing cap. Then "mike" the strands produced to learn where to remove shim stock to take up wear. On shell type bearings make a bridge gauge reading to determine wear on the lower half of the bearing. A feeler gauge will be needed to check between gauge and shaft. Babbit for all spots of wear. Look the impellers over carefully to note the wear at the rings and check vanes. Erosion, corrosion and cavitation raise hob at eye and discharge vanes.

Check the key securing the impeller to the shaft. Perhaps it can be driven home, or must be replaced with a larger one; or key ways must be recut to take a larger key. See that the clearance between impeller and casing wearing rings match up to design specifications. Pump performance falls off badly if the clearance of 0.003 inch is exceeded. Don't let the opening double the factory established clearance. The thrust bearing clearance can be checked by separating the shaft coupling and measuring the shaft movement from each side of the impeller, near the tips and housing.

MANAGEMENT SYMPOSIUM

Water Works Management—Part I

EDITOR'S NOTE: At the 62nd annual meeting of the Penna. Water Works Assn., these were nine papers presented on various aspects of water works management. The program had been arranged by John Murdock, Jr. president of the association. WATER & SEWAGE WORKS is fortunate to obtain permission to publish slightly condensed versions of the nine papers as a three part symposium on Water Works Management. Three papers appear in this section.

Philosophy for Managers

by ABEL WOLMAN, Prof. of San. Engr., Johns Hopkins Univ

■ THE AD HOC COMMITTEE on Public Information of the American Water Works Association presented a report reflecting in detail on the state of water works development in the United States. In this report, an appraisal was made of the difficulties now encountered in providing the best water service to the rapidly growing communities of the country. Among the obstacles to providing maximum quality service, high significance is placed on the deficiencies of management, the public, and technologists.

The Committee lists as the major road blocks to improvement in water service: lack of public appreciation, lack of realization of the problem by water works people themselves and lack of prompt planning for growth.

The U. S. Setting

Before attempting to evolve a philosophy for water works managers, it is well to spell out the setting in which such a philosophy may be expected to prevail. This setting likewise has been briefly reviewed, at least in part, by the American Water Works Association [2] and is paraphrased by the author (See Box).

In addition to the concrete characteristics of the present public water supply scene, even the amateur observer has become aware of the changing structure and the behavior of the people of the United States. This country is now confronted with 15,000 local governments, operating in 174 metropolitan areas, which include their surrounding cities of 50,000 or more population. As a matter of fact, most of the nation's increase in population since 1950 has occurred chiefly in the suburban portions surrounding the central cities. Historical solutions and principles governing water works development have not always proven to be appropriate to the new geographical and cultural developments. If it is recalled that about three-fifths of the nation's population now resides within such areas, one can no longer assume that the hand-to-mouth development on an inner core urban basis will always work. The trend here delineated gives no promise of cessation. It must be accepted, therefore, as the kind of development within which the water works manager must function. A recent Congressional Committee Report[3] apty describes this new urban pattern as "sprawling, still indecisive, and transitionally inefficient—but definitely new.—The process (of urbanization) has by no means run its course—indeed it promises to accelerate under the impact of the new Federal Interstate Highway System which will build 6700 miles of limited-access freeways in United States urban areas. The further explosion of our cities along these major highways —already experienced in Boston and some other cities—is a foregone conclusion."

The ultility problem posed by exploding areas, ribbon development,

"skip-jump" subdivisions and complete disregard for political boundaries represents one of the major challenges of the past century to the majority of water works managers. Past attempts to fit these curious growth patterns into the straight-jackets of municipal design and finance have been singularly ineffective.

What Are The Answers

Questions urgently requiring answers, within this new setting[4] :

1. How many people will be served by our public water systems 25 years from now?

2. How much of a growth will there be in water requirements in the next 25 years?

3. Is there a real problem now, or a possibility that a water shortage will develop in the future, or will there be an adequate supply for all necessary purposes?

4. How far can a city afford to go for its water supply?

SETTING FOR PHILOSOPHY

1. Some 18,000 water works function in the United States, each dominantly controlling the present and future welfare of the community.

2. Water for domestic, commercial and industrial supply is vital to urban communities.

3. Adequate water supply facilities are absolutely essential to the growth of our country.

4. A country-wide survey of water utilities, both publicly and privately-owned, indicates that:

a. One out of five is deficient in supplies.

b. Two out of five are deficient in transmission capacity.

c. One out of three is deficient in pumping capacity.

d. Two out of five are deficient in treatment capacity and very many need treatment facilities not now installed to provide the quality product desired by consumers.

e. Ground and elevated distribution storage show deficiencies of 29 per cent and 43 per cent, respectively.

f. Distribution system improvements are required in 57 per cent of the water systems.

g. Many systems need to undertake measures to place them on an improved business basis.

5. Present systems are deficient to meet present demands. Those demands are high and will continue to grow. Water systems must be kept in balance with those growing needs.

6. Water utilities have planned and budgeted water system improvements totaling over $600,000,000 for 1958.

7. Water works projects needed to provide balanced systems to meet the growing needs of each community will cost billions of dollars.

8. Most local water supply system improvements can be undertaken and financed locally and will provide long-term public benefits without creating inflationary pressures.

5. Is pollution of water sources to be permitted to jeopardize the public water supplies and whose business is it to see that pollution is kept under control?

6. How can water utilities, the most essential of all community services, increase the public appreciation of their contributions toward better living?

7. Finally, as the solution of all water problems depends upon adequate and sound financing, on what basis should water charges be computed?

As Howson points out, all of these questions are simple repetitions of the familiar questions to which water works managers have been perennially exposed. Certain fundamental differences in solutions appear, however, in attempting to respond to the challenge of these questions. The country now supports millions of people who stemmed from urban areas and who for half a century have become accustomed to the utility services which public and private units have provided. With their movement into areas with larger lot sizes, with less accessibility to water sources, with characteristics of fringe growth and with developments so often controlled by cheapness of land and by rapidly extending highways, new modifications of old problems emerge.

Basis for Philosophy

Regardless of the above circumstances, people are unwilling to accept primitive facilities and are not satisfied with arguments that modern engineering cannot and perhaps should not meet their desires. The water works manager, therefore, if he has not already done so, must find answers to these problems rather than maintain a stoical status quo. Such an orthodoxy of position deprives him of maintaining or acquiring the imagination and leadership which the community undoubtedly expects of him or of someone who will replace him.

One is aware that such reorientation implies redefinition of purpose, of engineering method, of fiscal evaluation and adjustment, and of the gradual evolution of novel experimental approaches to solving these problems.

In the light of these observations on the present way of life of the American people, it is now possible to define somewhat more specifically the areas of a manager's responsibility. By such definition, philosophy, as a guiding principle, will emerge.

Foresight

Perhaps the major obligation of a water works manager is to stand aside from the present and look at arm's length at the immediate and the remote future. He must be in a position to accept the emergency scene and its strange demands on and in relation to water service. It is in this obligation that the widest range of his imagination may be demonstrated. In viewing such a vista, he must escape the heavy hand of the orthodox past, except where it offers him a sound basis for imaginatively exploring the future. An imagination, tempered by the realities and practicalities of the market place, is the area where perhaps his greatest potential lies.

Some examples of such pressing questions are here noted. The water consuming habits of people and industry have not yet been completely explored and certainly not measured in detail. The literature is filled with assumptions of consumer behavior and with parallel assumptions as to the part which the water works developer may play in meeting or combatting this behavior.

Committees of water works practioners are increasingly exposing these areas of assumption to quantitative diagnosis and suggesting furthermore that sound appraisal of the underlying bases of these assumptions should be made in the field as rapidly as possible.

One such area, of course, is the familiar suggestion that summer sprinkler necessities cannot be met, except at undue expense in distributing system reinforcements. Is this true and if true, what are the parameters and what are their quantitative features? Studies in this area alone are amazingly meager and fragmentary.

Much has already been made of the necessity for a new look, both broadly and deeply, at the whole fiscal basis for water works development. Case histories abound in the United States of where water works managers, through ostrich-like appraisals of current problems, have retarded development and have in fact invited chaotic development.

Much of this attempt to stem the tide of growth (which incidentally still remains a major indoor sport for some water works managers) has its origin in the desire to maintain a tax base within municipal boundaries, to resist growth beyond the boundaries, to pursue rules of extension which have outlived their appropriateness, to gain little or no support from regulatory agencies for a reappraisal of the problem and to clinging to the eternal hope that somehow or another the future will be more peaceful and familiar in demands than the immediate past.

The history of almost every major

water area in the United States presents one or more of the above characteristics. It would be interesting on some future occasion to determine why this policy of resistance has so persistently prevailed. Water works literature has long made available to the water works manager alternative fiscal principles dating back to the proposals by Snow in New England, by Morse and Wolman in the Maryland area, by the Joint Committee of the American Society of Civil Engineers and the Section of Municipal Law of the American Bar Association, and more recently by Richard Hazen. Each of these reviewers of fiscal policy has emphasized for many years the necessity of imposing part of the cost of water utilities on property owners, whose property is enhanced by the availability of water and sewer service, whether or not they immediately use the service. In addition, much water distribution extension in metropolitan areas is geared to future land development.

Population growth, from the geographical standpoint, in the last 20 years makes new reference to these principles virtually a necessity for every water works manager. This is particularly true where necessary design and construction for the future consumer imposes an undue burden upon the present user, if capital costs are recaptured only by means of consumption charges. True regional water supply development, so characteristic of our rapidly evolving urban areas, cannot proceed within the confines of fiscal perspectives of the old municipality. The mere doubling of water rates to outside consumers by no means goes to the roots of this issue, as the last ten years' experience well demonstrates.

From a political standpoint, it is equally clear that the future will become more complicated rather than less. If the manager hopes to see in the future less prospect of psychological disturbance in meeting his responsibilities, he is foredoomed to disappointment.

Functional Operations

In the areas of design, construction, operation, and maintenance, the water works profession has an enviable record of which to be proud. That record is likely to be sullied, if the profession does not move with great rapidity to forestalling the deficiencies in all these areas which new growth is creating at high speed.

Here, again, the manager is confronted with the necessity of adjustment in sights. The ingenuity required in these functions is no less striking than in the solution of fiscal and economic problems of utility service.

Some water works purveyors are already demonstrating, not only an awareness, but imaginative answers to these growth problems. Both private and public service is being designed and constructed, which in fact skips geographical sections, while developing under single management satellite sources and distribution systems, geared to be linked through appropriate connection with existing systems as time and as growth may later demand or justify. Even rural areas are now being served with economy in the Washington Suburban Sanitary District.

Public Relations

There are distinguished examples of water works managers in the United States who have demonstrated superb capacity for public relations. They are unfortunately few in number. A recent review [5] of this situation leads to the conclusion: "it seems that the problems of management and administration have not been a serious concern of the water utility profession."

In other words, great concentration and successful implementation has gone into the utilization of material resources and relatively little into the relationship of such material resources to human problems.

The skill which some have shown in bridging this gap apparently has not infected large numbers of water works managers.

The almost universal desire to avoid political entanglement has virtually precluded many excellent technologists from taking a desirably effective position in the community. Politics remains to most as anathema, rather than as the art of governing people. In this essential art in a democracy the water works manager must find a significant daily part.

Organization

No successful management operation results from only the manager himself. Success is peculiarly the result of total organization. It is not the simple drafting of an organization chart, but is the characterization of an indefinable spirit of public service. Indefineable as that spirit is, it is quickly apparent in almost any contact with water departments or companies. The skill of a manager in having an all pervasive influence in the entire organization of public service is as important as it is elusive and rare.

Legal Assistance

Increasingly the problems of water service will create problems in law. The skillful guidance of the lawyer, more and more familiar with water service, becomes a major necessity to the manager. Again, awareness of the problems to be encountered, the issues to be met and the preparations for such encounters is being rapidly extended. They impose, therefore, additional responsibilities which historically were either simple or sometimes nonexistent.

Conclusion

One cannot review this entire scene without a strong sense of the difficulties involved in any water works manager's life. A rehearsal of the vices which he has developed over the years of his experience and of the virtues which the future may demand of him can only lead to a feeling of complexity and perhaps even of frustration.

In spite of this, however, the reflective manager will undoubtedly emerge from the present crises with a broader concept of his responsibilities and a deeper consciousness of the skills required for their implementation in order to make the most successful contribution to society. No simpler definition of a philosophy appears either possible or desirable. If such a philosophy must be firmed up in simple terms it has in fact been anticipated by the American Water Works Association in the slogan "Good water, the life blood of your community." The slogan itself virtually defines the limitless nature of the obligations of the water works manager.

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What is a Manager?

by FRANK C. AMSBARY, JR., Vice Pres. & Gen. Mgr., Long Island Water Corp., New York.

■ A MANAGER is, according to Webster—*one who manages—a person who conducts business or household affairs with economy.* Not much help, except as a starting point by considering that one who manages without economy is not a manager.

A water works manager must be a good businessman with a good technical understanding. He must accept the tenant that the basis of success of a water utility is providing adequate water service of acceptable quality supported by adequate rates.

Adequate Service, Quality and Rates

Service covers such a vast field. It includes adequacy of source of supply, treatment facilities, high-duty pumping, storage and distribution so that the customer has all the water he can *usefully use.* When this is assured the worst of the battle is over, but service goes further. Prompt handling of complaints, the courteous explanation of the cause, the company's efforts to keep such situations at a minimum. The answering of any questions if peculiar to the water industry should be a truthful and full explanation. The satisfactory answering of complaints is in itself not sufficient. A manager should be able to analyze the service conditions that have contributed to the complaint and map out a remedial program that will at least minimize recurrence.

Water quality means different things to different people but generally speaking a water that is safe, that is meeting USPHS standards, not over 5 grains in hardness, free of turbidity and non-corrosive, is generally considered being of accepted quality. This does not mean, of course, one will be free of complaints of roily water. But if water does not qualify as a water of acceptable quality under this general description, a manager's efforts should be bent in the direction to see that everything economically possible is done to attain this goal.

There is a direct relationship between adequate supply, water quality as has been defined, and adequate rates. Adequate rates are simply expressed as a gross revenue sufficient to meet all operating expenses, including taxes, depreciation, and interest requirements with a residual that will properly represent a fair rate of return on invested capital. No attempt will be made to define what is meant by a fair rate of return, since there is no uniformity on this problem among the various state utility jurisdictional bodies in the country. Some commissions will say the rate of return should be based on fair value, others on original cost. Some will say 5.25 per cent return is adequate and others will say as high as 6.5 per cent. If the manager is not in agreement with the concepts of the commission it is proper, and it is his duty to argue his point. But regardless of the interpretation, without adequate rates, the water utility cannot meet its obligations for adequate service with a quality water, and with adequate service and a quality water a fair return on the capital invested is the reward.

A Businessman

A manager should know how to intelligently read and analyze a financial report. Analyzing a report properly is basic in the economics of any business, and a water utility being a business, much can be learned about the operation by proper study of such reports. So even though he is not an accountant he must have a complete understanding of accounting procedures.

In any community a businessman is expected to expend a reasonable amount of time and energy in civic endeavors. So the water utility manager must allocate a certain amount of time to such work and when such a responsibility is assumed he must never fail. Such work is basic in the utility's public relations. The manager should not be the only one doing this class of work in his organization but he must set the example. He should encourage those with such capabilities and allow them reasonable time to engage in such activities.

Public Relations

The manager must be a man who

can say "no" without using that two letter word. We know that he is bound in the conduct of his business by Rules, Regulations and Conditions of Service as approved by that body within the state that has been delegated such jurisdiction. To explain to a customer why certain procedures are necessary rather than referring to the rules and regulations, takes more time, but with a complete understanding the customer leaves in a frame of mind that has made the extra time required of great value to the company. It is so easy to say NO that it is equally easy to overlook the improved public relations gained by spending the time to give full explanations and thus being assured the customer has a complete understanding.

Employee Relations

A manager must be able to get along with his fellow workers and command their respect. Some form of communication within the organization will accomplish this. There are many ways, briefly, he must be human, see that every employee knows what is going on and why, and be in a position to intelligently answer the questions of his friends and associates.

A manager must not forget that any organization is a cross-section of society, the brilliant and the dull, the generous and the grasping, the good and the bad. Grouped together the weakness of one is compensated by the strength of another and the composite will prevail. The manager's job is to see that there is no restriction on individual initiative and it is

important that each individual has the opportunity to exploit his talents to the fullest. That is good leadership and both the individual and the utility will profit. In this way over the years a strong organization will result.

Sanitary engineering makes an excellent background for a managerial position. Sometimes a sanitary engineer makes an excellent manager. If a sanitary engineer a manager must school himself in all the business aspects of the operation. But a man who has no such background can develop a good technical understanding of engineering, water chemistry and water bacteriology if he will apply himself. Yes, these experts can be employed, but the manager should know and be able to interpret what is going on and to be able to make intelligent suggestions and place himself in the position of being able to work with the expert.

The manager must be a man who will accept responsibility. It is easy to find one upon whom responsibility can be placed, but often that responsibility is not accepted. In addition, it is just as necessary that the manager be able to delegate responsibility and authority. In a smooth running organization it is necessary that responsibilities and authority be delegated. When so delegated and finding that responsibility has been accepted the manager should see that the man's position is never undermined. The manager must always stand behind his subordinates, accept blame for failures, giving due credit where success has been earned. An organization chart is helpful. From it each man knows what he is to do, from whom he receives instructions, and to whom he is to report.

It must never be forgotten that one can always learn from those under him. Jobs should be visited from time to time and discussed with those working on them. A manager must keep away from preconceived ideas, be alert and ready to learn improved approaches and techniques.

Community Relations

Complete knowledge of the mechanics of the Public Service Commission is a must even though such matters as rate cases, bond issues and other proceedings may be handled by others. In all of these matters the local manager is one of the necessary and important witnesses. In that position he must be calm, at ease and base his answers only on fact. In cross-examination by the Commission, it must be remembered that they are only trying to clarify in their minds and for the record certain facts that have been presented or related subjects that may have bearing. It is only if protestants may be present, represented by an attorney, that the witness must be exceptionally careful. There is nothing that pleases the protestants more than to watch their attorney twist answers and succeed in embarrassing the witness. He will bend every effort to see that his clients get their money's worth.

Acquaintance with the Commission staff based upon mutual respect not friendship, is of utmost importance. In the business of managing a water property, there are many instances where matters can be hastily and satisfactorily resolved on an informal basis. An acquaintanceship that has been developed to the point that the staff is convinced of the manager's honesty and ability is invaluable.

It is advisable to keep out of local politics, but a knowledge of the problems of the various tax supported bodies is a must. By knowing these men, and their problems gives the manager the opportunity to anticipate various actions they may take and be prepared to meet them. Their respect must be sought, gained and held. Here again a true trustworthy approach will accomplish this goal. After all, politicians are just men, men who have followed a different calling than the water plant manager, and all men will react in the same way to one that is trustworthy and knows his business.

A Planner

The manager should be a dreamer too. He should be able to put his feet up on his desk, staring out the window seeing nothing but those ideas he is conjuring in his mind. His familiarity with the geography of his service area permits his dreams to lay out areas that will most probably be developed and the improvements in source of supply, treatment, pumping capacity and distribution that will be required to adequately service them. In this way plans are developed so that in an orderly way the improvements are started and by the time their need arises the utility is ready for the additional demands. Yes, the dreamer is always ready and the community as a whole profits by the resulting readiness of the water utility. These dreams should be projected ten, fifteen and even twenty-five years into the future. If the utility does not have its own engineering department, these dreams are of infinite help to the consulting engineer that may be called in. It is unfair to expect the consultant to visualize all the problems of a system when he is called in only from time to time for consulation if management is not prepared to outline the probable future growth and areas of expansion as well as all existing problems.

In the unprobed complexities of America's future, the urgent need of the water works industry is for boldness mingled with prudence, audacity tempered with intelligent judgment—the kind of attitude and habit of thinking, in short, we have come to expect from top management in every line of endeavor in our great nation.

The Water Works Survey

by FRED MERRYFIELD, Consulting Engr. and Prof. of San. Engr., Oregon State College

■ THE WORD *survey* means to take a general or comprehensive view, to view in detail, especially by formal inspection or examination in order to ascertain certain conditions and values. Surveying, then, of a water utility must require first of all a rather intimate knowledge of the pur-

pose of a water utility, as well as its operation and the conditions under which it exists. A water works utility, in its minimal sense, is a useful organization for the purpose of delivering adequate and potable water to the customers of that utility. The utility may be a publicly-owned or privately-owned system, but that is of little consequence to the customer who insists that his demands be met. The only time the customer takes any interest in the water supply is when it fails to reach his home in adequate quantities or when the cost is considered too high. The basic well-being of our country is dependent upon the adequacy and service of this and other utilities.

From time to time, in any endeavor, it is necessary to sit back and contemplate on what we are doing, why we are doing it, and how we are going about it. No member of a water works utility, whether he be the manager, the lawyer, the engineer, the accountant, the superintendent, the field man, or the office clerk, should ever be allowed to forget that his main purpose is to serve water to the public consumer. In many of our undertakings, it is extremely difficult for many of us who are burdened with the details of the task to step aside and examine philosophically and practically our own contribution and the contributions of others. For this reason, we should bring in qualified people in the several fields to survey the situation and report to us in an understandable fashion. From such a report the future plans necessary to maintain and improve the services expected can be developed.

The Survey Team

The four phases of the survey—engineering, legal, financial, and management—are all part of a picture which must be developed coincidentally in order to achieve the best results. It may be difficult at times to separate one from the other. For these reasons, we will not attempt to separate them out or indicate areas of responsibility, but accept that fact that such people are necessary, to discover what the situation is, evaluate it, and plan for the future.

Simply hiring these people independently will not necessarily answer the questions raised. The work of the whole group should be integrated so as to present an intelligent picture of the present and possible plans and actions for the future.

Supply and Storage

Obviously, an inventory of the physical system must be obtained, verified, and evaluated. The source of supply upon which the whole system is based and justified will require a thorough examination, whether the water be obtained from surface or from underground sources. Measurements of the availability of the water in the past through to the present should be obtained if at all possible from the utility itself.

The storage of water and the effect of storage on quality is often unknown, or at least the records of such have not been kept. The conditions of the structures for the containment of such water and the details of the inflow and outflow characteristics of the reservoirs must be measured and checked. The effects of such things as erosion, logging, and pollution must be measured. Ownership and values of the land of the present and possible future sources should be obtained. Careful analysis of needs can effect great future savings in costs of real estate acquisition.

Surface water supplies are particularly vulnerable to the effect of long droughts. The adequacy and condition of storage facilities to reduce these water depressions should be examined along the historical records. Plans and construction of expanded facilities require considerable time in addition to financing. The legal requirements which must be resolved often require enabling legislation or court decisions in title acquisitions. These operations are time-consuming. Therefore, the present legal status and the statutes covering such storage requirements and plans must be known if future plans are to be developed and consummated.

Water Treatment

The facilities of water treatment should be checked for efficiency, costs, maintenance and operation. Records of water production, of the quality of the influent and effluent, of the amount of chemicals, power, and wash water used and of the costs of operation and maintenance are among the major items necessary to evaluate the plant efficiency. Physical examination of the equipment, settling tanks, and filter beds will not only show the present condition of the plant proper, but will also reveal the management's responsibility and operators' attitudes and abilities. This is one place the consumer can see and appreciate at least the superficial aspects of the water supply. The treatment plant along with courteous employees and the utility's offices are the three major points of customer and utility contact. Management stands or fails if any of these are weak. A survey of the plant itself can be very revealing.

Transmission System

Careful examination of the transmission line to determine its capacity, its condition, its probable future life, and also its stability should be made. Often times, one unearths the fact that certain property owners who have given right of way to the utility for the transmission lines have the right to water connections. Several little gems of this kind can cause serious trouble for a small expanding utility. If the treatment facilities are downstream from some of the connections, the liability of the utility might be quite serious. Several smaller utilities have been forced to place chlorination facilities in headworks at considerable expense and inconvenience to the utility in order to overcome this liability. Small matters like contact time might well force the utility to buy up these right of way connections which were quite logical when the deals were originally made.

Transmission Lines

It is not the most inexpensive operation to determine the physical condition of a transmission line. Rarely are transmission lines constructed above the ground surface. Pipe condition, however, can be partly inferred by point-to-point inspection of excavated sections. The historical record of original construction and of maintenance and repair to date will indicate areas of weaknesses and strength of the pipe. Hydraulic tests of pressure and capacity will show the internal condition. Capacity tests are often very difficult to make due to the hydraulic and structural design of this part of the system. They should be made where possible. Future plans should contain measuring devices to aid in forecasting length of life and change in capacity. Lining methods to increase capacity and

length of life are common practice today.

Distribution System

One could write volumes about the investigations of distribution systems. A physical inventory of a distribution system, if the records of the utility are not well kept, can cost an enormous amount of money. While most of the utilities have such records, many of the older utilities are faced with the very difficult task of determining physically what the distribution system is. It is extremely difficult to catch up with illegal connections, and in some instances it is an almost insuperable task to determine what has happened in the past.

Only by good pressure records, good repair and maintenance records, knowledge of soil and water quality, historical records of construction, and by physical internal and external examination of the pipe can one arrive at a reasonable estimate of the condition of the distribution system. Flow and leakage tests should be part of the standing order of operation in a well managed utility. Repair crews should be required to report pipe conditions. An examination of these records and a visual display of all this information on a map will reveal to the examiner valuable information not only on pipe condition but will reflect housekeeping and administration.

The presence of all kinds of pipe, valves, hydrants, etc., in a distribution system make the task of an examiner of such a system quite difficult. This, however, must be determined if a survey is going to fill the picture that is necessary in order to determine what the utility owns. The type of pipe and fittings are easily forgotten by even first-class crews unless adequate records are kept.

In recent years the past and present records of customers and the amounts of water they consume are being kept and made more available for the investigator of the water system. In the larger utilties, it is possible now to do by computors many things impossible without such devices. In future years, computer service records may be rendered to the smaller utilities. The production of water must be measured from the records of such measurements in comparison with the records of water sold to customers. It will be possible to make some deductions as to the ability of the system to render the service necessary.

Finances

No survey is complete without an examination of the financial operations of a utilities system. The utility only exists because these operations are carried out in a businesslike manner. Indebtedness, amortization, replacement, and operation costs must be broken down so that the financial picture of the utility is evident at least monthly. A survey of the physical facts of a water system is incomplete unless these financial data are kept up to date.

One may ask why a survey of a water utility is needed. The water supply field is a monopolistic business whether private or municipal, and is the furnishing of adequate and potable supplies of water to customers at the lower rate consistent with good business. Charging as much as the traffic will bear is just as stupid as not charging enough for the services rendered. In the water supply field, the former method is so rarely used, as to be ignored —though, there are some customers who do berate the utility employees and managers on the high cost of water.

In general, there is a long time between the initiation of plans and the consummation of construction. Customers can become very impatient in waiting for well-considered plans and will choose temporary stop-gaps in order to satisfy their immediate desires. Much time, effort, and money have been lost in many of these developments. Many of these newer and smaller utilities have been forced to annex themselves to other utilities which were already overburdened with their own development. Some, but not all, of the mistakes could have been avoided.

The cost of money is a part of the economic picture of the country. If a utility has a complete inventory of the physical assets of its water system, and is also operating and maintaining this system in a good, workmanlike manner, being financially repaid for such operations, such utility is in a position to buy low-cost money. In addition, if the utility has developed from its survey a series of plans for expansion, replacement, maintenance and development, then the utility, providing these plans are fairly flexible, can construct such projects as are needed and buy the money necessary for such construction at the best rate of interest. A utility that is ready, capable, and in position to take advantage of the bond market at the right time can serve the customer with water at a rate lower than that of a utility which has to go into the market for its money at a time when the interest rates are high.

Some Legal Problems

One is constantly shocked with the lack of interest of engineers and managers in the problem of water rights. Sometimes this ignorance can cause considerable trouble for the particular utiltity. At the present time, we are witnessing, particularly in the eastern and midwestern states of the country, the legal creation of many water resources and authoritative boards. These boards can have a profound effect upon the future of the water works industry. The ownership of the source of the water or of the water itself can have a very important bearing on the future of a utility. Certainly the legal status of this ownership should be investigated by competent lawyers retained by the utility for that purpose, and the utility should maintain a keen and close observation of the water laws being introduced into the various legislatures of that particular state. Future plans for implementing the source or going to other sources of supply should not only be investigated by competent engineers but also competent lawyers.

If the survey indicates that new sources of water supply will be necessary in the future, then priority type plans should be made. What is often lost sight of, is that fact that other individuals or groups of individuals may have plans for the use of the same sources of water to which the utility is directing its plans. Recognition of the needs of others and reasonable assumptions as to future demands should be a basis for the working out of future developments for all concerned. In some sections of the country, water for domestic purposes takes prior right over all other rights; however, such right does not necessarily infer the power of eminent domain. Drought, the bug-bear of any water works manager, must be provided for, in spite of the difficulties of forecasting such situations

and providing for ample supplies during such times. The customer has little interest in the explanations as to why the supply is low. Any utility, whether public or private, will be subject to much criticism during these periods and immediately following. It may be the fault of the customers in objecting to increased rates for the construction of facilities to obviate such droughts, but the water works manager and directors will be held responsible for such apparent negligence.

Stringent, but real, policing of the watershed or the stored water may become a necessity or in case of treatment, the impoundment may be open to the public for certain recreational uses. Preconceived notions as to the use of such water for these purposes can impair the judgment of the manager. Good will can often be obtained from the general public, not all of whom are customers, for the utility by allowing certain recreational uses. Recreational use of stored water can become and often is a difficult problem to resolve.

Management

No examination of a business or a utility can be divorced from the human beings who are responsible for the maintenance and operation of such systems. It is in this field of management where many of our utilities fall short. Employees must be trained and organized into subdivisions to operate and maintain the system. This requires, on the part of management, skills in the field of planning, organization, superintendence, and a good knowledge of human relations, so that orderly procedures are developed in routine administration. Examination of shops, trucks, field equipment, office procedures and office equipment are necessary in order to evaluate the efficiency of the organization. All of these can be splendidly done and still miss the mark of satisfactory performance unless management and utility employees are imbued with the spirit of service to the customer. A customer whose wants are satisfied in a human way and who is kept informed and advised of the plans and the needs for expansion is an intelligent customer who will respond favorably to necessary rate increases demanded by such developments.

Many of our sister utilities have learned from bitter experience that the human relationship of utility dealings require understanding, tolerance, and appreciation of the other fellow's point of view. If there is any spot in the water utilities field in which we have grave weaknesses, it is in the field of employee-customer relationships.

In this country there is probably as much wasted water in poor utility operation as there is by the customer. Accuracy of measurement of water will always present a challenge to the water works manager and the employees. Leak surveys and the constant checking and repairing of water meters of the system should be part of the maintenance program to develop the highest efficiency.

It is necessary for management to pay more attention to the problem of presenting data and plans to substantiate the voting of bonds or the increase in water rates. So much depends upon the understanding by the customer and the presenting of the facts in such a light that he understands them, that one cannot stress too much the necessity for management to spend time and effort in developing good communications with the customer and the directors of the utility. Long tables of technical facts can be replaced by graphical methods and charts which can convey the intelligence to the parties concerned.

Management must also be allied to the economic development of the community and take into its confidence the commercial and industrial interests who depend upon the water supply for processing and the carrying away of the waste products. To ignore such people in one's deliberations is to ask for trouble and lack of backing at the critical time. Many industries are not conscious of the value of water in their manufacturing and are not acquainted with the necessity of planning by the utility to provide them with water to fit their future needs.

Maintenance and Operations

It is also necessary to determine the effectiveness of maintenance and of operation. This applies not only to the field crews but also to the office personnel. Examination of machinery and equipment will reveal the effectiveness of management and the thought that management places on such operations. Poorly kept equipment, sloppy organization, dull surroundings, and disinterest in the work is usually manifest, even on casual inspection. The safety practices, the control of the field organization, the condition of the system, as manifested on instrument panels and in laboratories, all reveal to the examiner the condition of the system and the efficiency of management.

Growth and Records

No amount of crystal ball gazing can replace adequate records, and the records should be of such a character that the data needed are forthcoming. The unaccounted-for water may be reduced by reasonable estimates of uses for the utility itself, for street cleaning, fire fighting, and park uses. The comparison of records with the sewage treatment plant also gives some interesting data at times. A study of the history of the water system, as regards it capacity to furnish water, should also be investigated in order that the growth of the utility can be examined. Previous growth of the city and the type of water use, the history of the annexations and the possible annexations of the future, and the area to be served by the utility in the future must be taken into consideration. This growth of the past can be examined with respect to the population and growth of the economy of the city or area served.

Economic Review

It is necessary in any adequate survey to make an investigation as to the present value of a water system and also of the financial arrangements under which the system operates. Cost accounting is a must in any utility. An examination of such records can indicate discrepancies in operation, the condition of the system, and the adequacy or inadequacies of financial control.

A review of the financial statement of the utility will also indicate the financial health and well being. Amortization schedules, replacement, and monies for maintenance, operation, and interest should be investigated as to their adequacy.

Many of the water rates structures now used in our utilities, both public and private, are not related to the facts of life. Monies are needed for the complete financing of the operation, including adequate salaries and money for future developments and planning.

Three Texas Cities have definite policies for . . .

Sanitary Sewer Extensions

by S. A. GARZA, Supt. Sanitary Sewer Div., Austin, Texas
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EDITOR'S NOTE: The subject of sanitary sewer extensions was discussed at the Texas Water and Sewage Works Short School held at Texas A. & M. College. Each writer told of the policy established by his city.

The present population trend to ex-urban or semi-rural living has caused problems to those municipal governments who are without definite policies concerning annexations or construction of sewers in fringe developments. The problem of financing necessary construction or reimbursing annexed areas for previous construction should not be made a burden to old consumers.

In the following articles the policies established by the cities of Austin, San Antonio, and Abilene are explained.

Sanitary Sewer Extension Policies, City of Austin

■ SEWER EXTENSION POLICIES must be administered on basically two types of properties. One type is property that is being subdivided or resubdivided and a second type is property that is an original tract, within one hundred feet of a sewer and never has been served.

Subdivided Property

In September 10, 1953 an ordinance was passed repealing several older ordinances and prescribing rules and regulations, governing plots and subdivisions of land within the corporate limits of the City and within five miles thereof. This ordinance states that a sanitary sewer shall be installed to serve each lot, in all subdivisions, where connection is to be made immediately to a community disposal system or to a public sewerage system. In the event connection to a system will not be made immediately, plans shall be prepared for future development and installation of a sewage collection system to serve each lot. Those parts of such a system which lie in streets and alleys which will be paved shall be installed prior to paving.

All work is done under the supervision and approval of the Director of the Water and Sewer Department, in accordance with the ordinances and regulations set forth by the City of Austin.

City Policy

Through a resolution passed by the City Council, the following policies govern participation by the City of Austin in the cost of construction and installation of sanitary sewers in subdivisions inside the city limits or within five miles of the limits of the City:

1. Where sanitary sewer lines of certain sizes are required to adequately serve an approved subdivision; if the cost of the lines as installed, has been approved by the City; the City will pay the extra cost incurred in constructing the larger lines, based on City estimates of the cost of the smaller lines.
2. Where both a water distribution system and a sanitary sewer system are installed in accordance with City specifications in an approved subdivision within the City; and where either system is so installed when the other system is already in place, upon the transfer of such systems to the City; the City will reimburse the subdivider to the extent of ninety per cent of the cost thereof, provided the cost thereof has been approved by the City. Upon this transfer, the City will assume maintenance and operation of such systems.
3. Where either a sanitary sewer system or a water distribution system is installed in accordance with City specifications, in an approved subdivision within the City, and the other system has not been and is not installed, upon the transfer to the City of the system so installed, the City will reimburse the subdivider to the extent of eighty per cent of the cost thereof, provided that this cost has been approved by the City.

Financing Policy

The above amounts of costs that will be reimbursed are regarded as principal. Interest thereon shall accrue annually at the rate of three per cent per annum on the unpaid balance. Interest shall accrue from the date of acceptance by the City. If both sewer and water systems have been installed by the subdivider and are transferred to the City, the City shall pay to the subdivider on or before March 1, of each year following the completion of the construction work, a sum equal to three-fourths of the amount of income realized from sales and service of water. This applies only to those customers having a direct connection to water and sewer lines within the subdivision during the preceding calendar year. Payments shall continue until the full amount of such principal due plus accrued interest has been paid *or* until payments have been made from the income so received for a period of twenty-five years from the date of completion and acceptance of the systems for which reimbursement is to be made, whichever first occurs.

These payments are made first on the interest accrued, and the remainder shall be applied to the payment of the principal.

If a sewer system or water system only is installed by the subdivider and transferred to the City, then the City shall pay to the subdivider on or before March 1, of each year following the completion of construction work, a sum equal to three-eighths of the amount of income realized from the sale of water during the preceding calendar year. This shall continue until full payment is made, plus the interest accrued, *or* until payments have been made from the income so received for a period of twenty-five years from the date of completion of the system for which reimbursement is to be made, whichever first occurs.

Areas Outside City Limits

Where both a water system and sewer system are installed in an approved subdivision outside the City and outside of any Water Control and Improvement District, and where either system is so installed when the other is already in place; upon the annexation of such subdivision, and the transfer to the City of both such systems, the City will reimburse the subdivider the extent of ninety per cent of the depreciated value of the systems. The value is determined by depreciating the original cost thereof three per cent per year from the date of completion of such plant to the date of annexation of the subdivision, provided the original cost of such systems has been approved by the City.

In the event either a sanitary sewer system or a water distribution system is installed in an approved subdivision outside the City and outside of any Water Control and Improvement District, and the other system has not been and is not installed; upon the annexation of such subdivision and the transfer to the City of the system so installed, the City will reimburse the subdivider to the extent of eighty per cent of the depreciated value as explained previously. Reimbursement is made under the same financing policy.

Whenever both sewer and water systems have been installed, the City will pay to the subdivider following the year of annexation of the subdivision three-fourths of the amount of income from the sale of water or until payments have been made from the income so received for a period of twenty years from the date of annexation of such subdivision, whichever first occurs. If just one system is installed three-eighths of the amount of income from the sale of water will be paid or until payments has been made from the income so received for a period of twenty years from such annexation of such subdivision, depending which occurs first.

Original Unsewered Property

On the second type of property where sewer extensions are required the following policies are followed: Each original tract within the City of Austin is entitled to 100 feet of line, provided the property can be served by such an extension and a sewer tap is paid. If more than a hundred feet is required, the property owner has three methods of making financial arrangements:

1. The property owner will take all construction costs involved and enter into a refund contract with the City.
2. The City will bear the construction cost of the first 100 feet and the property owner will bear all remaining cost with no refund.
3. The City and property owner may negotiate for a financial arrangement whereby the property owner will bear his pro rata cost and no refund contract will be required.

Extensions have been made to areas that are isolated provided the house count and their payment of sewer taps, justifies a house for every 100 feet of line that must be extended.

There are many instances where property is resubdivided and in so doing the creation of a new lot can necessitate an extension. In this case, the property owner or subdivider will have to make fiscal arrangements to serve the newly created lot or tract of land. The City in this instance will not extend the 100 feet and the owner will have to either enter into a refund contract or negotiate his pro rata cost of the extension.

Sewer Extension Policies, City of San Antonio

■ IN SAN ANTONIO at the present time, sanitary sewers are extended by five methods: 1) Bond Funds, 2) Participation, 3) New Subdivisions, 4) Township Extensions and 5) Refund Contract.

Each of these methods will be briefly discussed with advantages and disadvantages of each.

Bond Funds

At the present time, the majority of sewer line extensions are being made with bond funds. Bond funds were voted in 1955 and again in 1957 for sanitary sewer improvements. In the 1955 bond issue, $2,250,000 was voted for sanitary sewers of which

$1,185,000 was earmarked for sanitary sewer extensions in unsewered areas. This work is almost complete and resulted in 112 miles of sewer extensions. The 1957 bond issued passed allocating a total of $3,350,000. Of this total, $469,810 was earmarked for extensions to serve unsewered areas, the remainder being set up for main extension and relief lines, and additions to the sewage treatment plant.

Advantages of Bond Extension

1. Areas are served that otherwise would probably never be served, particularly existing subdivisions.
2. Individual financing is no problem, as is the case with other methods.

Disadvantages of Bond Extension

1. It is not fair and equitable to those who have paid to have sewer lines extended.
2. If bond issues don't carry, sewer lines are not extended.

Participation

In this method, the people wanting a sewer extended will pay for the labor of extending the line, and the City will furnish the engineering and materials. For an eight inch line, this cost is approximately $1.00 per foot for the property owner and $1.00 per foot for the City.

Advantages

This method is a "happy medium" method of sharing costs and permits more extensions by the City.

Disadvantages

This is not fair, considering those obtaining extensions under bond programs.

New Subdivisions

Under new subdivision regulations just passed by the City, the developer is responsible for extending sewer lines within the proposed subdivision, as well as providing the main of a size based on utlimate development to connect the proposed subdivision with the existing mains. Plans and specifications must be submitted for approval and bond must be posted to assure proper construction.

Advantages

1. No cost to City.
2. Home owner pays on long term basis.

Disadvantages

1. Developer feels City should share in connection main.

Township Extensions

Sewer lines in townships connecting to the City sewer system are installed at the expense of the township. The City charges a sewer service charge for the out of town connections. Connections are presently limited to capacity of the plant and trunk lines.

Refund Contract

Under this system, which has been abolished by the City, the person installing a line has the right to charge a connection fee to anyone connecting to the line for a given period of time. The connection fee varies with circumstances.

Advantages

The City's sewer line can be extended when City funds are not available.

Disadvantages

It is not fair for some to pay for sewers and others get theirs free. People feel that once a sewer line is laid in a public street, they should be permitted to connect.

Sewer Extension Policies, City of Abilene

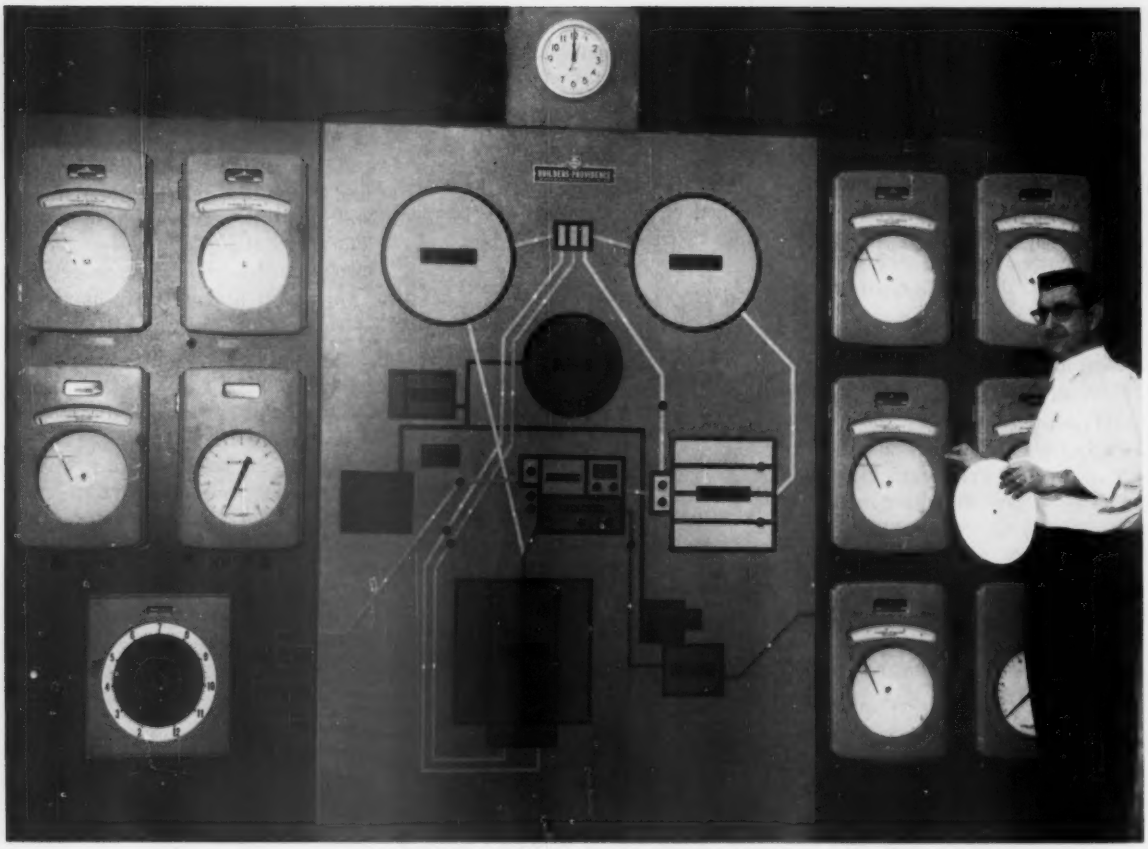
■ IN RECENT YEARS the City of Abilene has operated with a sewer extension policy that has been largely financed by subdividers and developers of property.

Where a new subdivision or development has been opened for building purposes, the developer is required to bear the cost of installing both water and sewer lines in accordance with plans and requirements of the City of Abilene Water and Sewer Department. The one exception to this rule is where the City has desired, for various reasons, to install sewer lines in excess of 10 inches in size. The extra cost of pipe in these instances has been borne by the City. This policy has held true both with respect to subdividing and developing of property within and without the city limits. However, where developments are outside the city limits, city limit extensions have been made to incorporate them soon after utility installations are completed.

When major trunk lines or new interceptor sewers are required to serve a new development, the cases have been handled on their own merits. Normally, the City would require the developer to bear the expense of extending the main to his property. However, the experience to date in all cases where any major extension has been involved, lines have of necessity been designed to serve other extensive areas, and the City Commission has seen fit to pay the cost of these major outfall or interceptor lines. This has eased administrative burdens concerning that property which has been developed adjacent to these major sewer main extensions.

To date, no service or connection charge has been made to developers for having these facilities provided. However, the City has considered adopting a policy whereby the developer would pay a connection fee based on area served. This charge would be in addition to the investment by the developer in the sewage collection lines within his subdivision or development.

The City's present policy has proven very effective and is accepted by the developers. A primary advantage of such a policy is that the City can make their capital investment in major interceptor, out-fall sewer lines, and treatment facilities without the necessity of expending available funds on the installation of lateral collection lines within subdivisions.



PANEL of indicating, recording and controlling devices is part of modern approach to . . .

Instrumentation and Control *in waste treatment*

by WALTER H. BROWN, Project Engineer,
Builders-Providence, Inc., Division of
B-I-F Industries, Inc., Providence, R. I.

EDITOR'S NOTE: Measurement and control of flow of fluids and of quantities of materials becomes more and more important as modern practice in sewage and waste treatment progresses toward more complete automation. In this article, the author has reviewed the various applications of instrumentation and control, types of devices, where they are used and other pertinent information on the subject.

■ IN ALL of the unit treatment processes for sewage and waste treatment, either liquids, gases or solids (or all three) are handled, moved or stored in some manner, and in every process, reasonably complete and accurate measurement (metering) and control is essential to obtain maximum operating efficiency and minimum cost of operation. No operator of any such process can be assured that operation is proper unless he knows the conditions under which the process functions.

Included in the several unit processes of treatment applied to sewage

Table 1

Equipment Used in Unit Treatment Processes

UNIT TREATMENT PROCESS	Class or Type of Equipment										
	Special (See Notes)	Chemical Feeding	Flow Measurement	Mixing (Rapid)	Operation Control	pH Control	Proportional Pacing	Pumping	Tanks (1)	Temperature Control (2)	Weighing
Salvage			x		x			x	x	x	x
Screening	14	x	x	x	x	x	x	x	x		x
Sedimentation	15		x		x			x	x		
Flocculation & Sed.	11		x	x	x	x	x	x	x		
Flotation	12	x	x	x	x	x	x	x	x	x	
Chem. Coagulation & Sed.		x	x	x	x	x	x	x	x		
Neutralization		x	x	x	x	x	x	x	x		
Chem. Oxidation-Reduction	6	x	x	x	x	x	x	x	x	x	
Aerobic Biol. Oxidation	3-4		x		x	x		x	x		
Anaerobic Digestion	5		x		x	x		x	x	x	
Filtration	10		x		x			x	x		
Dewatering	8	x	x	x	x	x	x	x	x		x
Drying and or Incineration	9				x					x	x
Lagooning	13	x	x		x			x			
Chlorination	7	x	x	x	x	x	x	x	x		

NOTES:
1 - Reaction, Sedimentation, Storage Tanks, etc.
2 - Heating Systems, Heat Exchangers, Temp. Rec.
3 - Activated Sludge, Trickling Filters, Oxidation Ponds
4 - Air Blowers, Air Diffusers, Air Flow Measurement, Mechanical Aeration
5 - Mixers, Heating Equipment, Gas Collection
6 - Aerators, Chlorine Dioxide Generators, Ozonators, Reducing Agents, Redox Control, Oxidation Reduction Potential (ORP)
7 - Chlorine Gas Feeders
8 - Chemical Conditioning, Elutriation, Filter Press, Vacuum Filters, Sand Beds
9 - Incinerators and Dryers
10- Sand or Pressure Filters
11- Mechanical or Air Flocculators
12- Vacuum or Fine Bubble Flotation
13- Includes Oxidation Ponds
14- Mechanical Screens, Grinders, Comminutors
15- Sludge and Skimmings Collectors and Sludge Pumping Equipment (Special equipment inherent to the process may include several of the types of equipment listed, as accessory equipment.)

and waste treatment are the following:

Screening
Sedimentation
Flocculation & Sedimentation
Flotation
Chemical Coagulation & Sedimentation
Neutralization
Chemical Oxidation or Reduction
Aerobic Biological Oxidation
Anaerobic Digestion
Filtration
Dewatering
Drying and/or Incineration
Lagooning
Chlorination

Table 1 shows the equipment, and general types of instrumentation and controls used in sewage and waste treatment processes. In addition to these processes used in sewage treatment, sewage works often have water pumping stations and boiler plants as integral parts of the works. They, also, utilize instruments and controls common to those particular operations.

Reasons for Instrumentation and Control

Reasons for instrumentation and control vary from the simple measurement of quantities handled to the complex control of the ratio of two or more quantities of liquids, gases or solids. Some of the problems involved are briefly outlined in the following paragraphs.

Screening is a mechanical process for the removal of large particles of suspended matter; it may also involve weighing of material removed if that factor is important. Operation and control are generally on a time cycle basis.

Flocculation by mechanical means, or by air, followed by sedimentation is used where coalescence of fine particles to form settleable flocs is desired. If air is used, air-flow measurement and control in relation to liquid flow is effected by ratio controllers. Where mechanical flocculation is used flow measurement and control of flow to maintain proper detention time are used.

Flotation to remove suspended matter is practiced where the specific gravity of the solids is about that of water and where these solids can be caused to rise to the surface either under the influence of (a) natural buoyancy, (b) fine bubbles introduced into the liquid or (c) fine bubbles produced by desolution of dissolved gases under the influence of a vacuum.

Measurement and control of flow are important; important too are the measurement and control of air introduced, or of a partial vacuum, if used. In some industrial wastes, chemical treatment prior to flotation is practiced with controls of chemical feeders from pH recorder-controllers and/or from flow metering devices.

Chemical Coagulation and Sedimentation are less frequently used in sewage treatment than in industrial waste treatment, but wherever chemicals are used, accurate flow metering is required to automatically pace the chemical feeder dosage in proportion to the flow. Precise chemical feeding can result in saving, the cost of instrumentation, many times over. Too much or too little chemical can interfere with settling waste chemicals, or kill process bacteria.

Neutralization of acid or alkaline wastes is almost always controlled through pH recorder-controller systems connected with dry or solution chemical feeders and is particularly vital if biological processes are to be used.

Chemical Oxidation or Reduction are processes used almost exclusively in the treatment of industrial wastes. Here pacing of chemical feeders in relation to flow may be accomplished by pneumatic or electrical control systems from primary flow measuring devices. In some instances, control of chemical feeders is from pH recorder-controllers or from ORP (oxidation recorder controllers) through electrical or pneumatic transmission of the information to proportioning weir boxes.

Anaerobic Digestion involves control of volume input, withdrawal of overflow liquor and digested sludge, temperature, and pH, all of which must be measured as well as controlled. Temperature control is most critical, but pH records indicate proper or improper operating conditions which are usually controlled by raw sludge input and digested sludge withdrawal or addition of corrective chemicals. Gas produced by digestion is a

Table 2

INSTRUMENTATION IN SEWAGE AND WASTE TREATMENT

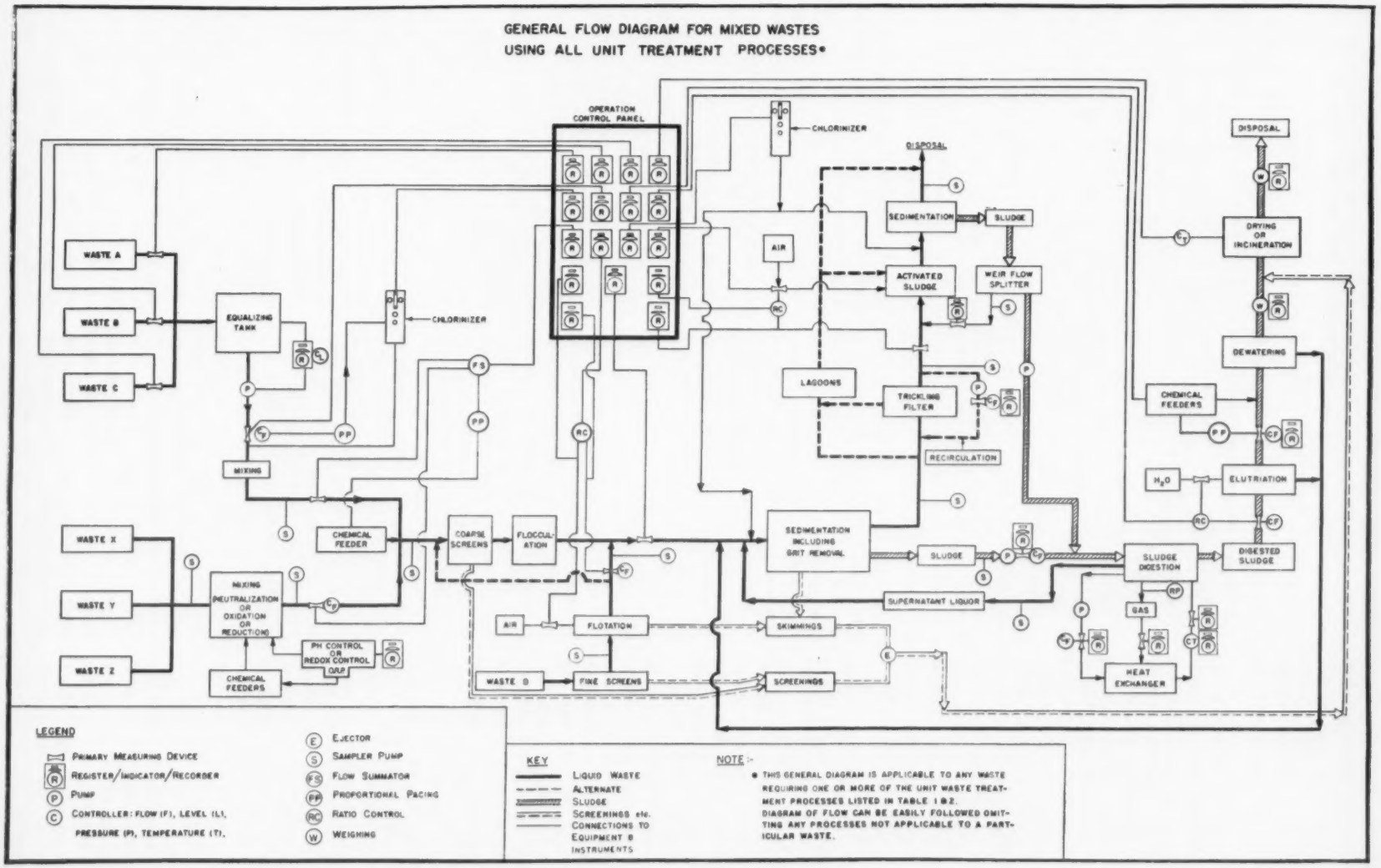
TYPE OF INSTRUMENTATION AND METER LOCATION	PRIMARY MEASURING DEVICE													RECEIVING INSTRUMENT *														
														MECHANICAL**						ELECTRICAL **						PNEUMATIC **					
														Adjacent			Remote [1]			Adjacent			Remote [2]			Adjacent			Remote [3]		
	Municipal Sewage	Industrial Waste	Open Flow Nozzle	Venturi Type [5]	Flume	Orifice	Propeller	Weir	Conveyor Scale	Displacement Meter	Gauge	Rotameter		T	I	R	T	I	R	T	I	R	T	I	R	T	I	R	T	I	R
FLOW MEASUREMENT																															
Pumping Station	x		x	x										x	x	x							x	x	x				x	x	x
Plant Influent	x	x	x	x	x			x						x	x	x					x		x	x	x				x	x	x
Primary [3] Effluent	x	x		x	x			x							x									x					x		
Primary [3] Sludge	x	x	x	x										x	x	x							x	x	x				x	x	x
Aeration Air	x	x		x		x								x	x		x	x					x	x		x	x		x	x	
Return Activated Sludge	x		x	x				x						x	x	x							x	x	x				x	x	x
Excess Process Sludge	x	x		x				x						x	x	x							x	x	x				x	x	x
Recirculating Lines	x			x								x[4]		x	x	x							x	x	x				x	x	x
Digested Sludge	x	x	x	x										x	x								x	x					x	x	
Elutriation Water	x			x		x	x					x[4]		x	x								x	x					x	x	
Plant Effluent	x	x	x	x	x			x						x	x	x							x	x	x				x	x	x
Digester Gas	x	x		x		x				x				x	x									x	x	x	x		x	x	
Fuel Oil	x									x	x												x						x		
Electric Power	x	x									x				x	x								x	x					x	x
Chlorine Gas	x	x										x[4]		x	x	x				x	x	x		x	x	x	x			x	x
Chlorine Solution												x[4]																			
PRESSURE MEASUREMENT																															
Digester Gas	x	x									x				x									x					x	
Aeration Air	x	x									x				x									x					x	
Plant Water	x	x									x				x									x					x	
Incinerator Draft	x	x									x				x	x								x	x					x	x
TEMPERATURE MEASUREMENT																															
Digester Gas	x	x									x				x									x					x	
Aeration Air	x	x									x				x									x					x	
Plant Waste		x									x				x									x					x	
Raw Sewage	x										x					x									x						
Sludge Digesters	x	x									x					x									x						
Digester Heating System	x	x									x					x									x						
WEIGHT MEASUREMENT																															
Filter Cake	x	x								x				x	x								x	x					x	x	
Grit	x									x				x	x								x	x					x	x	
Chlorine	x	x	(Scale)																					x	x					x	x
LEVEL MEASUREMENT																															
Miscellaneous Wet Wells	x	x									x					x							x						x		
Digester	x	x									x					x							x						x		
RATIO GAUGES																															
Air - Sewage	x										x					x							x						x		
Sludge - Sewage	x										x					x							x						x		
Elutriation Water-Digested Sludge	x	x									x					x							x						x		
MISCELLANEOUS																															
Rainfall	x										x																				
pH	x	x									x													x	x						

Notes:
* Actuated by transmitter of corresponding type, where required
** T = Totalizer; I = Indicator; R = Recorder
1 - Up to 1800 ft.
2 - Any distance
3 - Primary or initial sedimentation
4 - Indicator only
5 - Magnetic flow meters also applicable

measure of operating conditions (as well as a usable by-product) and its measurement is necessary. Where stage digestion is practiced, the volume of sludge transferred must be measured and recorded.

Filtration through fine sand or gravel is practiced principally with certain industrial wastes in which instances rate of flow controllers, loss of head gauges and flow measuring devices are used.

Vacuum Filtration of sludges (raw, excess activated, digested) is commonly practiced in many plants where



GENERAL flow diagram for mixed wastes using all unit treatment processes.

lagooning or other methods of disposal are not feasible due to the plant location. Such filtration calls for the automatic pacing of chemical feeders and bucket elevators as well as the control of the level in the vacuum filter tub.

Drying and/or Incineration of sludge is practiced in the larger plants where fertilizer is produced or where disposal of the ash presents a simpler problem than disposal of wet, dewatered or air dried sludge. Drying and/or incineration may take place in either a multiple hearth furnace or a flash dryer furnace. In either case, instruments include recording pyrometers at multiple locations.

Lagooning of sewage, waste or sludge usually involves nothing more than flow measurement and recording, except that this presupposes the occurrence of sludge which must be measured and disposed of.

Chlorination is an important process in both sewage and industrial waste treatment. It is employed principally for disinfection, but it also is used for its oxidizing and odor destroying power and to control activated sludge bulking, to prevent trickling filter ponding and to control trickling filter flies and sludge digester foaming.

Chlorine is commercially supplied as a liquefied gas under pressure. After being vaporized, it is generally fed under vacuum in a chlorine feeder which precisely governs the feed rate and delivers a chlorine solution to the point of application. Control of chlorine feeders may be by manually set rates but modern practice is to pace the feeder automatically according to sewage flow rate, or in accordance with a pre-established program. Pacing of chlorine feeders may be done from Venturi tube, Telemeter or summation units. Supplementary instruments used in conjunction with chlorine feeders include those which record the rate of flow of the chlorine feeder and those which record loss in weight from containers on weighing scales.

Flow Diagram

In the accompanying flow diagram, instruments and controllers are indicated at the various locations of any system which would involve *all* of the unit treatment processes listed above. In general, the left half of the diagram represents processes used in the treatment of industrial chemical wastes; the right half of the flow diagram generally applies to the treatment of domestic sewage and organic industrial wastes. To determine instrumentation and controls for specific wastes or sewage simply cross out any processes which do not apply or are not to be used and the proper flow diagram for that waste or sewage will be apparent.

Table 3

Control in Sewage and Industrial Waste Treatment

AUTOMATIC CONTROL OF	AUTOMATIC PROPORTIONAL	STEP[1] ON-OFF	TIMER[2] ON-OFF	PROGRAM[3]	LEVEL ON-OFF
Pumps - Waste		x			x
" - Sludge			x	x	
" - Recirculating	x	x		x	
Chemical Feeders	x	x		x	
Clarifier Mechanisms			x		
Samplers	x	x		x	
Grit Chamber Mechanisms			x		
Grit Washers			x		
Screens			x		
Chlorine Gas Feeders	x	x		x	
Tank Levels					x
Alarms					x
Ratio Gauges	x				

Notes: 1 - In step with pumping or flow rates
2 - In accordance with predetermined time cycle, fixed rates
3 - In accordance with predetermined program, variable rate

Instrumentation

Table 2 lists the functions of instruments in sewage and waste treatment plants and the various points where instrumentation is desirable together with the most commonly used differential producers and primary devices. Available types of meters and functions are given; the combination used is generally a matter of choice dictated by the specific installation. The functions tabulated in Table 2 are not necessarily the only ones applicable to any given condition but represent those most commonly used. The differential producers and various types of meters are described hereafter.

Flow Meters provide information on the volume of sewage or waste, the volume of sludge withdrawn from settling basins, the amount of air supplied, the amount of return sludge, etc. This information is invaluable in the determination of unit loadings and efficiencies which are desired for maximum detention times. Orifice type meters are definitely not recommended in sewage works because of the suspended matter in the liquids handled and the high non-recoverable head loss. Flow meters, particularly of the Kennison or open flow nozzle type, are also used to measure the flow of industrial wastes into municipal sewers, particularly where charges for sewer service to industry are based on volume of waste discharged.

Pressure Recorders provide visible evidence of aeration diffuser clogging. Prompt cleaning means that excess power costs will be avoided. Pressure recorders are also useful to indicate digestion tank gas pressure, gas burner supply pressure, process water pressure, etc.

Level Recorders are used in sludge storage tanks, etc.

Temperature Recorders are used, not only on the digestion tank contents but also on the digestion tank heating system. Some localities prohibit the discharge of wastes to sewer system or streams above a maximum temperature. Temperature recorders provide the local authorities with a record of the effluent temperature.

Controllers

Table 3 lists various equipment which can be automatically controlled by a variety of standard methods. Chlorine gas feeders, chemical feeders, samplers and recirculating pumps can be *automatically* paced by means of electrical or pneumatic transmitters which send out impulses in direct proportions to the flow. In addition to the above units, waste sludge and recirculating pumps can be controlled

in steps according to tank levels or by means of switches in flow instruments.

Timers, which provide on-off contacts, can be utilized for control of sludge and recirculating pumps, and sedimentation tank, grit chamber and screen mechanisms. This equipment is used where rates and time intervals of operation are fixed and the cycle repeated.

Program Devices are available for control of sludge and recirculating pumps, chlorine gas feeders, chemical feeders and samplers. These program controllers are extremely useful where a variable rate is required and can be predetermined; the program is variable but repeats after a definite time cycle.

Simple On-Off Level Switches can be used for control of waste pumps, screen mechanisms, maintenance of tank levels, and alarm systems.

Summary and Comment

In sewage and waste treatment, experimentation and study of process operation is highly desirable. To make such experimentation possible, it is necessary that measurement and control of all variables be possible, which means complete instrumentation and control are essential in order to ascertain the facts of operation.

Several types of industrial waste treatment processes provide varying decrease of purification and material reclamation. These processes require instrumentation and control for efficient operation.

The choice of particular treatment processes, either for sewage or industrial wastes, depends on the individual waste and on local conditions. Each problem needs individual study and engineering design, which means that instrumentation and control as well as treatment process are designed for the patricular problem. Variations of the above-mentioned standard control systems can often be engineered by the several water and sewage instrument manufacturers.

It is extremely desirable to provide instrumentation and control units designed especially for several decades of life and for which repair parts will be available over that period.

USPHS Water Pollution Control Activities Resume

The basic legislation under which the Public Health Service carries on its water pollution control activities is the Federal Water Pollution Control Act of 1956.

Following are seven general areas in which these activities are carried on:

Program Grants

The Act authorized $3 million a year for 5 years in annual Federal grants to support State and interstate pollution control programs. States are required to pay from one-third to two-thirds of the cost of these programs.

State and interstate agencies have used program grants for employing technical personnel, for purchasing special laboratory and field study equipment, for research, and for stronger enforcement of State laws.

Technical Assistance

Many States have pollution problems of an unusual or difficult nature, and request technical assistance from the Public Health Service. These services have included full-scale river studies, evaluation of State laboratory operations, evaluation of new waste treatment processes, and special investigations into episodes of waterborne disease epidemics and large fish-kills.

Research

A principal objective of Public Health Service research, carried on mainly at the Robt. A. Taft Sanitary Engineering Center in Cincinnati, is to develop more effective and less costly sewage treatment processes.

Other research at Cincinnati involves methods of freeing water supplies from viruses and bacteria, detergents, insecticides, radioactive contaminants, and other substances which can make water unfit or unsafe.

The Water Pollution Control Act also provides for research grants to public and private research agencies and to qualified individuals.

Under the new Act, Federal funds for research have been doubled to about $1 million a year.

Basic Information—Monitoring

The Public Health Service has under way a long-range basic data program which includes:

1. A national network of 50 sampling stations on interstate streams to measure water quality. Additional sampling stations are needed both on main streams and their tributaries.
2. Inventories of water, sewage and industrial waste facilities in the U. S. These are published at regular intervals.
3. Compilation of data on contract awards for water facilities, sewers, and sewage treatment facilities to show what progress is being made in meeting the Nation's needs.
4. Economics studies to find ways of determining what pollution is costing the American people and the costs of controlling it.

Interstate Enforcement

Where pollution of interstate waters endangers the health or welfare of persons in a State other than the one in which the pollution originates, the Surgeon General and the Secretary of Health, Education and Welfare are empowered to take action to abate such pollution. The procedure calls for three steps: (1) a conference with the State and interstate agencies involved, (2) a public hearing before a board appointed by the Secretary, and (3) possible Federal court action.

Construction Grants

The Water Pollution Control Act authorized grants to States, interstate, municipal or intermunicipal agencies to assist in the construction of sewage treatment facilities. Annual appropriations of $50 million were authorized, to a total of $500 million. For fiscal years 1957, 1958 and 1959 a total of $140 million has been appropriated.

During the first two years of the program, Federal grants totalled $95 million and the States and municipalities put up $610 million of their own funds.

Training

The service offers advanced training for engineers, chemists and other scientists from Federal and State agencies, municipalities, industries and foreign countries. The Sanitary Engineering Center gives short, intensive laboratory and classroom courses and holds seminars and conferences on new subjects of interest.

REPORT FROM ABROAD

The Bondi Outfall Treatment Works at Sidney, New South Wales, Australia has . . .

Units Underground

by J. GRINDROD, New Milton, Hants., England

■ A VAST UNDERGROUND sewage treatment plant, estimated to cost approximately $3.7 million is now under construction at Sydney, N. S. W. and the plant, designed to eliminate pollution from beaches adjacent to the Bondi sewage outfall, is due for completion in 1959.

A State Government Board was appointed to draw up a scheme for the sewerage of Sydney and suburbs in 1873. Two separate main sewers were recommended and constructed. They are comprised of a northern system with an outfall into the Pacific Ocean north of Bondi and a southern system with an outfall to a sewage farm on Botany Bay, south of Cooks River. The northern system provided intercepting sewers for the various smaller outfalls which previously had discharged into the harbour.

At that time, the area close to and north of Bondi Bay was sparsely inhabited and the immense dilution afforded by discharge into the ocean was considered a satisfactory solution to the problem of sewage disposal at the metropolis. The major outfalls are all situated on headlands and discharge into deep water between 20 ft and 30 ft below water level. The dirty stream normally flows out to the east until caught by the north-south littoral drift.

Design Criteria

Serving an area of approximately 8,779 acres with a contributing population of nearly 302,000 persons, the Bondi outfall sewer has an average daily dry weather flow of 20.5 mg. The main outfall sewer is 8 ft deep by 7 ft 6 inches wide and is of oval design. The oldest of the systems is the city collection system which was constructed in 1857. The outfall itself, completed in 1889, has a very large variation in flow rate since portions receive stormwater in addition to foul water. It is from 115 ft to 150 ft below the natural surface of the headland. The drainage district is very closely settled and no great expansion in population is expected.

The rates of flow for the system are:

Maximum storm flow	230 cfs
Future maximum dry weather flow	77 cfs
Present maximum dry weather flow	60 cfs
Present average dry weather flow	38 cfs
Present minimum dry weather flow	15 cfs

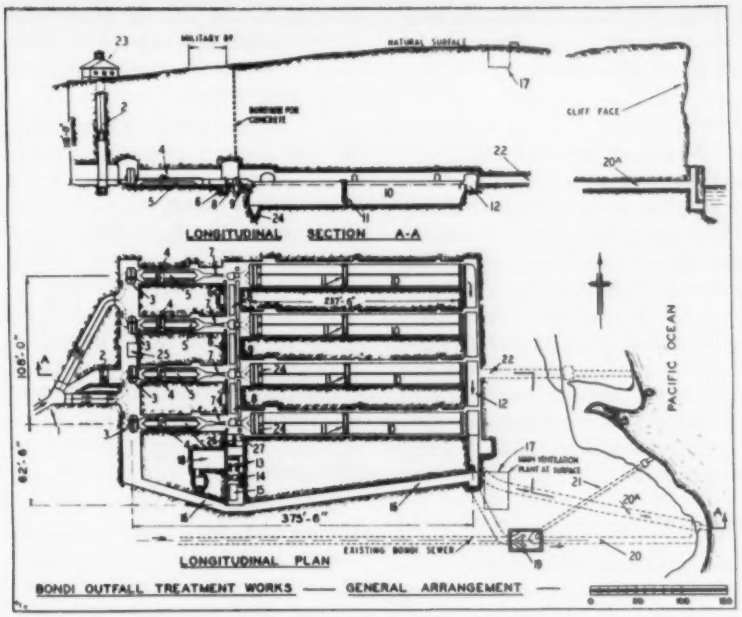
Analysis shows an average suspended solids content of 380 mg/L in the sewage.

SEDIMENTATION TANK, underground, shows sludge and scum scraper approaching automatic scum trough in foreground. Partition for roof ducts partially formed in rock ceiling.

Project Objective

With the growth of the city and the contributary systems to this outfall, together with the intense development of the ocean-side suburbs which followed from the popularizing of surf bathing, the local council and other organizations were led at various times to complain that the adjacent beaches were being polluted from the Bondi sewage outfall. This occurred chiefly whenever a strong wind with an easterly trend arose, and caused floating material to be carried to the shore.

After investigation, the Metropolitan Water, Sewerage and Drainage Board resolved in 1936 to adhere to the principle of disposing of sewage by direct discharge to the ocean, since this proved economical, but also resolved that present and future out-



REFERENCES: (1) Distribution Chamber, (2) Lift & Shaft, (3) Drum Screens, (4) Grit Pump & Gantry, (5) Grit Chamber, (6) Grit Channel, (7) Ventri Flume, (8) Cross Connecting Channel, (9) Sludge & Scum Channel, (10) Sedimentation Tank, (11) Sludge and Scum Scraper, (12) Effluent Channel, (13) Grit Pumps, (14) Scum & Drainage Pump, (15) Sludge Pumps, (16) Access Tunnel, (17) Ventilation Plant, (18) Electrical Equip., (19) Ventilation Shaft, (20) Existing Sewer Outlet, (20A) Effluent Outlet, (21) Northern Outlet, not in use, (22) Construction Tunnel & Bypass Outlets, (23) Administration House, (24) Sludge Hopper, (25) Disintegrators, (26) Sludge Wells, (27) Scum Wells.

falls should be equipped with suitable and efficient treatment works to remove all matter liable to create a nuisance. The Bondi treatment plant was the first to be constructed under this programme. Here, the aim is to remove from the sewage all floating or settleable matter and to allow only the settled effluent and any collected grit to proceed to the sea.

Existing Sewer Promotes Unusual Design

The Bondi sewer had been constructed in a rock tunnel and the whole area of any treatment works had, therefore, also to be constructed by excavating in the rock. The design for excavations stipulate that the width of any tunnel should not exceed 30 ft and the thickness of buttresses between main tunnels is to be not less than 24 ft. The design also provides for the interception of the existing 8 ft 6 inch by 7 ft 6 inch oviform brick-lined sewer by a concrete-lined diversion sewer to a junction chamber where electrically-operated penstocks will automatically control four branches to four parallel treatment lines. Each treatment line is designed to take a quarter of the maximum storm flow of 230 cfs and consists of a cup screen, a grit chamber and a sedimentation tank. Soft screenings are fed to any one of a battery of three disintegrators, where they are cut into small sections and then returned to the raw sewage flow. At the outlet ends of the four grit chambers, a common cross connecting channel leads to the four sedimentation tanks. The treated sewage is finally discharged to the effluent channel and thence via the existing submarine shaft to the ocean (see Fig. 1).

At the southern end of the cross connecting heading, provision is made for a pump chamber. This chamber contains collecting wells to which grit, sludge and scum will gravitate and from which grit is pumped direct to the ocean and the sludge and scum pumped to the units for treatment and disposal. The design provides for the mechanical ventilation of the whole of the workings. Up to ten changes of air per hour will be pumped through the plant by a required total fan capacity of 120,000 cfm. Deodorization of the foul air will be by modern methods.

Conditions Underground

Begun in 1936, excavation was continued until 1942 when the war caused operations to cease. Work was resumed again in 1946 and has since continued without serious interruption. The total estimated excavation in the tunnel is 66,880 cu yds, of which 66,830 cu yds, or 99.9 per cent, has been removed.

The depth of the construction shaft is 115 ft and the various chambers of the works are wholly excavated in rocks of the Hawkesbury Sandstone formation consisting principally of massive and current-bedded hard, tough and impervious sandstones with less frequent shale beds. The massive types of sandstone are not affected by exposure to the atmosphere but the current-bedded types tend to split away slowly along the current beds. The shales, on the other hand, fret away fairly rapidly on exposure and have required covering with a protective layer shortly after excavation. Practically horizontal, the beds of rock show no sign of earth movement apart from one or two vertical rock joint cracks. No igneous dykes were intersected.

Because of the nature of the sandstone, the roofs of the sedimentation tanks and grit chambers could be left structurally unsupported, and the impervious nature of the rocks and the lack of open joint and fault cracks has made possible the safe excavation of large chambers below sea level and in close proximity to the sea. A minor amount of groundwater seepage occurs from joint cracks and the contacts between some of the sandstone beds.

Initially, most of the excavated rock was moved by electric-winch-driven scrapers and fed to a belt conveyor which, in turn, delivered to the foot of a bucket elevator in a shallow shaft within the face and near the bottom of the cliff. After being elevated to the surface, the spoil was dumped toward the sea whence it ultimately disappeared during heavy storms. Three-quarter yd mining trucks were later used for excavation. These were raised in the construction shaft cages and the spoil dumped into a bin for ultimate disposal. Tubular scaffolding was used for constructing ramps for the haulage of spoil from the lower

levels up to the flat level of the construction shaft.

Requirements and Methods For Construction

The concrete mixing plant was sited on the surface immediately above the cross-connecting channel at a point midway between No. 2 and 3 sedimentation tanks. The ingredients were weigh-batched in two-bag batches (eight bags of low-heat cement per cu yd). The mixer emptied through a bell-mouth into a 100 ft bore hole drilled through to the roof of the cross-connecting channel and lined with 6 inch bore casing grouted in throughout its length to preclude access of ground water. From the bore hole, the concrete discharged into a hopper-bottomed steel coffin box carried on trestle work to the various levels required. Rubber-tired rickshaws, having about 3 cu ft capacity, were filled from the coffin box.

Some of the rock walls in this Bondi underground treatment plant are both long and high. For example, the overall height of sedimentation tank walls is about 30 ft, while the overall height of the pump chamber walls is about 48 ft. To facilitate the wheelling of the concrete to the various sections of the works and to meet constantly changing construction levels of the rock walls, which have all been lined with 6 inches of concrete, tubular scaffolding was found particularly useful for the erection of staging and platforms in the fairly confined spaces of the excavations. Grouted steel dowels placed at 3 ft centres in staggered rows were used to hold the concrete to the rock walls.

Drains

A system of ground water drains in combination with accessible sumps was installed to prevent the build-up of back pressure. Asbestos cement troughing was used as formwork for the drains. A similar system of drainage applies to the floors of the sedimentation tanks, screen chambers and grit chambers. The concrete work also carries cored ducts to give a 2 inch by 2 inch clear cross section for electric wiring for power and lighting throughout the plant.

Screens

Each treatment line consists basically of a cup screen with ancillary disintegrators, a grit chamber and a sedimentation tank. Each cup screen has a diameter of 18 ft and an effective width of 5 ft 3 inches and is housed in a splash-tight steel plate structure which rotates on a horizontal axis. Bronze screen plates around the perimeter are perforated with ½ inch square holes at ⅝ inch centres in both directions. Sewage enters at the open upstream face of the drum screen. During rotation screenings retained on the screen mesh are lifted by way of transverse trays secured to the inner perimeter and deposited into a hopper from which they pass in combination with wash water to exterior fluming where they gravitate to the disintegrator well. Means are provided in the line of fluming for the segregation and removal of heavy solids which could cause damage to the disintegrators.

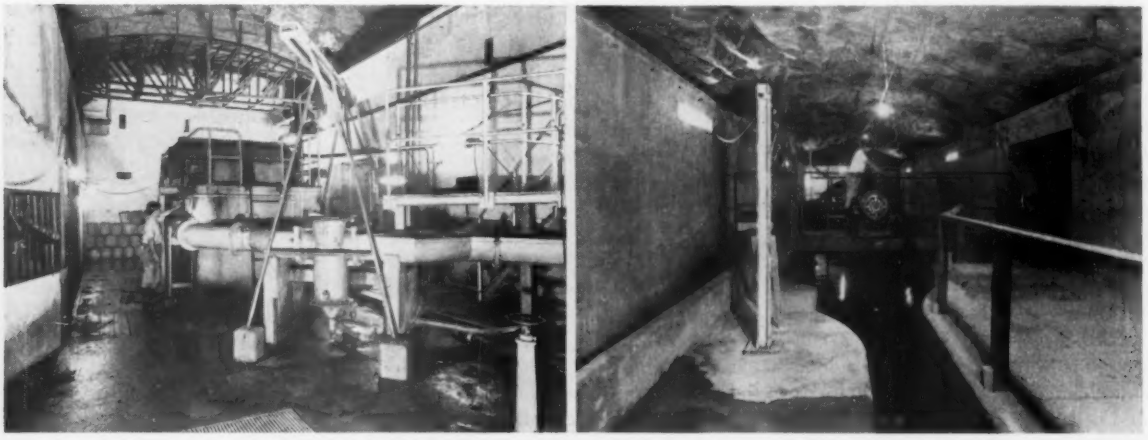
To keep the screen plates clean, high-pressure sewage effluent jets are played continuously on their outer surface and a rotary wire brush is applied intermittently. A 50 psi pump draws clear effluent from the effluent channel to supply the jets. Power for the screen is provided from a 5 hp electric motor connected through a three-speed gear box giving a range of speed of one revolution in two to four minutes.

Disintegrators

Although one disintegrator can deal with all the screenings under dry weather conditions, three have been installed: one in operation, one acting as standby and one being overhauled. Constant overhaul is necessary to maintain sharp cutting edges and prevent major chokages. Each machine is driven by a 17½ hp electric motor.

Grit Handling

Each of the grit chambers consists of a twin channel 55 ft in length excluding transitions. Each channel has a central gutter in which the grit settles. Flow is maintained at approximately 1 ft/sec at all rates of delivery between 15 and 57.5 cfs. The settled mixture of grit and sewage solids are removed by a 7½ hp electrically-driven centrifugal pump which travels on rails along the full length of the chamber. Grit is discharged



SCREEN INLET—GRIT CHAMBER with Screenings flume from screen to rubbish sump, on left, and Venturi, at right, with Gantry Grit Pump discharging grit into collection channel at left.

into an open side channel, whence it gravitates to the grit channel constructed in the cross connecting heading. From this channel it passes to a central grit well in the pump chamber from which it is pumped into the sea.

Control and Recording

A venturi flume will be installed at the effluent end of each grit chamber for recording, integrating and charting the rate of flow and automatically controlling the four electrically-operated penstocks at the distribution chamber and those at the effluent ends of the grit chambers. By this means the number of grit chambers in use at any time will be governed, and the velocity in the grit chambers can be maintained at 1 ft/sec at any rate of delivery between the minimum of 15 cfs and the maximum storm flow of 230 cfs.

Sedimentation Tanks

In the 235 ft long, 24 ft wide sedimentation tanks which give a minimum water depth of 18 ft 9 inches, the detention period will vary between 8 hrs for minimum dry weather flow to ½ hr for maximum storm flow. A manually operated vertical slot control gate installed at the entrance to each tank enables the flow from the cross-connecting channel to be equally distributed.

A specially designed baffle has been installed at the influent end of each tank, where there are also two sludge collecting hoppers in the otherwise level floor of the tank. A Dorr-type scraper, working on rails over the full length of the tank and driven by an endless wire rope through pulleys and a reduction gearbox from a ½ hp electric motor, moves sludge and scum to the inlet end. Its blades are automatically raised prior to the reversing of the machine and remain raised during the return trip. On reaching the rail stops at the effluent end the blades are again automatically lowered for another scraping mission.

Capable of being adjusted to varying flow levels, the scraper travels at a speed of 3 ft/min in both directions. It discharges the scum into a scum trough where it flows in channels constructed in the cross-connecting heading to wells in the pump chamber. A transmitter, installed in a floor well at the effluent end of the sedimentation tank, actuates a receiver on the scum trough drying motor which automatically raises or lowers the trough according to the flow level in the tank.

Ventilation

A ventilation system, based on model experiments, has been evolved for all tanks and channels carrying exposed sewage. A ceiling made of hardwood framework and sheeting is being installed in each area at the level of the springing of the rock arch of the excavation roof. The duct is divided by a longitudinal partition; one side is used as a foul air exhaust duct and the other half a fresh air inlet duct. Foul air is drawn from the surface of the sewage through openings in one side wall of the tank by a horizontal duct and discharged by vertical ducts, at intervals, to the foul air exhaust duct in the roof cavity. Fresh air passes from the fresh air duct through adjustable perforation and vanes in the ceiling to strike downwards toward the sewage. In the screen and pump chambers, vertical exhaust and inlet ducts connect with the respective exhaust and inlet duct cavity and provide the necessary ventilation.

Project Progress

First to be completed under the project were the diversion sewer, distribution chamber, channels to No. 1 and No. 2 screens, the northern portion of the screen chamber (with the exception of the concrete arch roof), No. 1 and No. 2 grit chambers, No. 1 and No. 3 sedimentation tanks and the effluent channels. The walls of No. 2 sedimentation tank were constructed as high as possible with the temporary timber flume in position.

Work proceeded rapidly on No. 4 sedimentation tank. The completion of the cross-connection channels would require only a short section between No. 3 and No. 4 treatment lines. This was to be finished before the 1957-58 summer so that the two stationary grit pumps in the machinery chamber could discharge grit, sludge and scum to the sea, by way of the construction by-pass tunnel.

A large amount of experimental work in regard to prevention of corrosion had been undertaken and test sections of various types of paints are located throughout the works.

Partial treatment of the sewage was begun at the Bondi plant by diverting a flow of approximately 80 to 120 cfs (30,000 - 42,800 gpm) to the works. This has helped to prevent nuisance on the adjoining beach and has enabled the operators to gain experience and solve some of the problems normally associated with plants of this magnitude. Sludge disposal facilities have not been completed and operating experience is expected to provide valuable information on this aspect of treatment.

Gadget for Cleaning Pipe Before Installation

J. C. Moomau, Manager, Northern Illinois Water Corp. at Sterling, Ill., sends the accompanying photograph with the comment, "to avoid sterilization problems, install a clean pipe in the first place."

"That is what we try to do. One of our men, Forrest Nutt, invented this little gadget and won a $5.00 incentive prize for doing it. Here he is pointing out some mechanical feature to Big Jim Burke, the foreman.

"The cleaner is made of three common scrub brushes, built around a half inch pipe into which a liberal amount of holes are bored. The brushes are on springs to cause them to hug the walls of the pipe. The supply of water is from a garden hose feeding a 20-foot length of half inch pipe. A handle at the opposite end enables the operator to revolve the brush as he sees fit.

"We rarely have a sterilization problem and give credit to this cleaning brush for doing a part of the job."

The effects on sewage treatment plant operation are important aspects of . . .

Industrial Wastes

in municipal sewage plants

Part II

by THEODORE JAFFE, Professor of Civil Engineering,
Alabama Polytechnic Institute, Auburn, Ala.

AUTHOR'S NOTE: The first part of this article[1] discussed industrial wastes in general as to characteristics, and differences from domestic sewages. Some of the simpler test procedures for detecting industrial wastes were also mentioned. This second part will relate reported effects of wastes on sewage treatment plants with the difficulties caused, and the remedies tried.

■ INDUSTRIAL WASTES may affect the operation of any sewage treatment unit located anywhere from plant influent to plant effluent. They may pass through a plant and cause difficulties in the receiving stream by oxygen demands, sludge deposits, toxic materials, etc. They may cause trouble in the collection lines even before the waste enters a treatment plant.

Collection Systems

Since the collection sewers are the first portion of a disposal system, let's look at some situations that have arisen in the sewers due to industrial wastes. At Ballston Spa, N. Y. the municipal sewers receive wastes from various industries[2]. Among these industries is a hide and leather company discharging three tons of lime per day, along with other wastes, particularly hair. This combination tended to settle in the 30 inch interceptor as lime deposits and long, stringy masses of hair. To loosen these accumulations, an expanding type sewer cleaner is pulled through the sewer twice a year. The solids are allowed to continue down the system to the treatment plant (cleaning is done during high flows) and the material is removed at the grit chambers and wet wells. (See later section on grit removal.)

Prior to the adoption of a sound sewer ordinance in 1950, the Hartford, Conn. Sewage Plant had some difficulties with a metal pickling waste entering its collection system[3]. This was an acid waste (sulfuric acid), which under prior agreement could be discharged up to "480 cu ft of 1 per cent sulfuric acid over a 24 hour period if diluted down to 0.1 per cent and never more than 0.2 per cent"[3]. The waste, over a nine year period, disintegrated the Portland cement joints of 10 inch sewer tiles, attacked manhole bases and mortar joints, and deposited large amounts of iron scale. The solution to this problem lay in the new ordinance which set a lower pH limit, and an iron limit. It was further recommended that the industry install a grit chamber to remove the scale, and adjust the pH to comply with the new ordinance.

Incidentally, acid wastes may be discharged by any industries, using a pickling or cleaning step in their process; the acid manufacturing industry, chemical plants making or using organic acids and many other miscellaneous chemicals. While this is not a complete listing of possible sources of acid wastes, it should indicate the types of industries that might discharge an acid waste to a sewer system.

To summarize, the collection system difficulties that may be caused or increased by industrial waste discharges are: a) clogging; b) deterioration; c) explosion or fire hazard; d) coating of the sewer interiors; e) odors; f) interaction of one waste with another to cause any of the above conditions.

Screens and Grit Devices

Industrial wastes may increase the volume of screenings and grit to be removed. They may interfere with the operation of these devices (and comminutors) by clogging or jamming them. Some types of industries that may discharge this type of waste are: vegetable canning, chicken processing; hog slaughterhouses; tanning; fish and shellfish canneries; resins and plastics; etc.

The situation at Ballston Spa, N. Y. mentioned above[2] regarding a tanning industry caused large amounts of grit to reach the treatment plant. Here, under normal operation 4 cu ft per day of solids are removed from the grit chamber. During the cleaning of the interceptor, 20 cu ft per day are removed. Most

of the grit removed will consist of sand, lime deposits, and masses of hair and rag materials. These difficulties carried through into the sedimentation and digestion tank.

At the Niagara Falls, N. Y. plant[4], organic chemicals (resins and plastics) were discharged into the sewers. Among other troubles, these interfered with the screening operation. The plant had fine disc screens with 1/32 inch openings. These resinous materials would clog the screens. It was then necessary to take the unit out of service and remove the material by scraping and steam. How this situation was remedied was not stated in the article referred to.

Often, plant operators have temporary troubles, such as happened at Celina, Ohio[5]. A tomato cannery, connected to the municipal sewers, had screening units at the cannery. On one occasion however, these broke down and the sewage plant received the unscreened wastes in such quantities that the comminutor broke down. The rotten pulp and tomatoes piled up against the bar screen and had to be removed manually.

Sedimentation

Most any industrial waste having large amounts of settleable or suspended solids may cause an overloading of the sedimentation facilities at a treatment plant. Greases and oils will also cause trouble in these units. Large, sudden, fluctuations in flow may cause hydraulic overloads in primary tanks. This too, is bad for operation since these tanks can only remove solids effectively if sufficient detention time can be achieved. A large increase in volume of flow may shorten the detention time to such an extent that solids removal may drop close to zero. Often, these large, hydraulic shock loads are composed of relatively clean waters, e.g. cooling waters, and could be discharged to storm sewers or the receiving stream without any treatment. Plant operators experiencing large flow fluctuations might well investigate this possibility of direct discharge.

Secondary Treatment

Filters, activated sludge, and sludge digestion, all employ microorganisms to remove pollutional materials from liquid wastes. Since this removal is a biochemical action brought about by living creatures, the environment and food must be acceptable to them, and non-toxic. Moreover, the quantities and rates of feeding must be to the organisms' liking. It is up to the plant operator to control these factors in so far as he is able.

Many industrial wastes however, create such extremely adverse conditions that the operator cannot keep control and then the treatment process ceases to work. This is not a fault of the operator necessarily, but rather a characteristic of his workers—the microbes. The solution to the problem usually lies in adaptation of the microorganisms to the waste, better control at the plant, or possibly the exclusion of the waste from a secondary treatment plant. Many of these undesirable wastes might possibly be better handled by chemical precipitation and sludge filtration, or some other means.

The literature contains many references to problems of this sort. One plant in Fremont, Ohio[6] mentions that frequent slugs of acid wastes have stripped the filters of zoogleal growths, thus rendering the filters ineffective. At this same plant, on another occasion, large amounts of oil were received. Some of this passed onto the filters, producing clogging and ponding. The oil had to be removed before operation could be resumed.

Plating waste discharges are thought to have caused ponding and sloughing of the media from filters at the Marion and St. Mary's sewage treatment plants in Ohio[7]. At these plants the filter slimes were removed from the beds, at different depths. Upon examination for copper, chromium, and cyanide it was found that these had accumulated in the zoogleal slimes and were apparently affecting treatment efficiencies. At another Ohio plant, using the activated sludge process, this retention and accumulation was noted in the activated sludge. Apparently the microorganisms employed for sewage treatment tend to gather in metals and by so doing, retain enough to harm or even kill themselves. The organisms will not only retain the metals mentioned above, but will also retain nickel, copper, zinc, and others.

Another type of difficulty experienced in some plants is the increased organic loading on secondary treatment units caused by certain industrial wastes, such as organic chemicals, packing and slaughter houses, fermentation industries, some foods, and others. Most of these produce wastes in solution or colloidal solutions. With this type of waste very little removal or reduction is obtained by primary sedimentation. This means that we cannot count on having the usual 25 to 35 per cent removal of B.O.D., because the load in these wastes is soluble, not suspended. Failure to take this into account leads to serious overloading of the secondary treatment units. These wastes can be even more of a problem if they are received in fluctuating flows.

Activated sludge plants receiving packing house wastes may have had difficulties with sludge rising in their secondary settling tanks. This may be due to increased nitrification of the organic material in these wastes. It has been suggested[8] that rapid removal of the secondary sludge will relieve the situation, but will not cure it.

Digestion

Since sludge digestion is a biological process, it too may be adversely affected by some industrial wastes as are secondary treatment processes. Certain industrial wastes, particularly toxic metals, will inhibit or even stop the digestion process; other wastes may be beneficial.

Two instances of increased gas production in digesters might be mentioned here. Both of the plants received milk product wastes and both of them experienced an increase in the gas produced. The Celina, Ohio plant discussed above[5] received as much as 25,000 lb of skim milk per day. When the milk had entered the digesters, gas production rose immediately, and within a short time, doubled in volume. The quality of the gas was not effected.

Another similar instance, this being whey, was reported from Marion, Ind.[9] Here, the increased load on the digesters was 18 per cent of the total load, and gas production increased. The same plant, on another occasion, handled 11,000 gal of condensed milk by bringing it directly into the digesters rather than through the plant. This was done so that the activated sludge process would not be upset by this huge, organic overload.

Digestion operation does not always benefit from industrial wastes,

however. One example is that of the Ley Creek Plant, at Syracuse, N. Y.[10] Here pencillin manufacturing wastes were discharged to this activated sludge plant. It soon was noticed that the secondary sludge was much lighter than that from domestic sewage. This imposed a burden on the digesters because of a large volumetric load, even though the organic solids load might remain the same.

Another type of difficulty is that reported from Monroe, Mich.[11], with the wastes from paper mills. In this case, because of heavy concentrations of the sludge, the pumps from the clarifiers to the digesters would clog. In the digesters themselves, heating of the sludge became a problem because large volumes had to be pumped. Further, the digesting sludge tended to separate into three layers, a heavy fibrous-like material on top, a supernatant layer in the middle, and a heavy sludge at the bottom. The sludge could not be mixed and would even break the heating coils because of its compactness.

Miscellaneous

The use of chlorine, either pre or post chlorination, can be greatly influenced by industrial wastes. In some instances, plants receive chlorine or similar oxidizing materials in their influent. The Niagara Falls plant mentioned previously[4] has received as much as 300 to 800 mg/l of free chlorine in its influent due to industrial wastes. On the other hand, the same plant often found that the chlorine demand of the influent might go to 100 to 200 mg/l due to chlorine reacting compounds from chemical industries.

Another example of high chlorine demands has been reported at the New Haven, Conn. plant[12], and is attributed to a textile dyeing plant. By measures taken at the dyeing plant, the problem was brought under control.

One point needing attention is the possibility of some of these wastes interfering with laboratory tests, particularly the B. O. D. test. If the wastes contain chlorine, toxic metals, reducing substances, and other materials, the B. O. D. test may give results that are grossly incorrect. Plant operators and chemists must constantly be alert to these possibilities in running the tests and in interpreting the test results.

Industrial wastes very frequently cause odor problems. These odors may arise in the collection system, the treatment plant, or both. Some odors may be unpleasant, while others may be harmful, and still others may be dangerous. The odor problem has been discussed in a previous article of this series[13], and so only one rather unusual problem will be mentioned here.

At the Suffern, N. Y. treatment plant[14] complaints about odors were received. However, the complaint was that the odors were "like perfume" rather than like sewage. It was found that these odors, (not affecting operation), were due to a cosmetic manufacturing plant. The offending—but not offensive?—portion of the waste was segregated at the manufacturing plant site, treated, and discharged into the river.

While many other situations could be described where industrial wastes affected plant operation adversely, these examples should indicate the types of difficulties and some of the wastes responsible. It should be remembered however, that several industrial wastes might be combined to produce a less troublesome waste, e.g. an acid waste from one manufacturer might be mixed with an alkaline waste from another plant resulting in a neutral combined waste. Sometimes we can combine wastes to precipitate objectionable materials, or to neutralize offensive odors. This combining of wastes must be carefully done for it is possible that the resultant waste might be more objectionable than any of the original ones.

If industrial wastes cause such problems, the question arises: "Why admit these industrial wastes into a municipal collection and treatment system?" The answer to this question was discussed in part one of this article[1] and will not be repeated here. However, illustrations of how industrial wastes and municipal sewage can be treated together without difficulties can be found in the literature. One of these is the South San Francisco plant[15] handling packinghouse, tannery, laundry, and pickling wastes, along with domestic sewage.

The matter of combined treatment is more of a designer's problem than an operator's; for these schemes to work well, a treatment plant must be designed to accommodate and treat industrial wastes. If the industrial wastes are tapped into an existing system, it is very likely that difficulties may arise. In this connection it is interesting to note the results of a survey[16] of 200 sewage treatment plants handling domestic sewage and industrial wastes as recorded in Table 1.

Table 1
Industrial Waste Problems at Municipal Plants

Problem	Plants Replying (%)
No problems	39
Flow tolerated at reduced efficiency	20
Flow can be handled by special operating techniques	14
Flow can be handled by installation of proper equipment	29
Problem cannot be solved at treatment plant	17

The import of the above figures lies in the fact that only 39 percent of these plants did not have problems or a loss in efficiency associated with the industrial wastes. Further, 17 per cent of the plants felt that no possible change in operation nor special equipment would enable them to successfully treat the wastes. These are rather remarkable statistics!

Sewer Ordinances

No discussion of industrial waste treatment at municipal plants would be complete without mentioning sewer ordinances. By means of an ordinance, industrial waste discharges may be controlled. Some wastes—toxic, hazardous, etc.—might be completely excluded from the system. Others will have limits set on them such as pH limits; lb of B. O. D. per day; lb of chlorine demand per day; etc. Still others may be admitted into the system only after preliminary treatment at the industrial site, e.g. the screening of feathers from poultry processing wastes; the removal of hair from hide and leather wastes, etc. Some wastes may be segregated with certain portions held and discharged over a period of time instead of in concentrated slugs.

Another advantage of a sewer ordinance is to set up an equitable basis for treatment charges. Indus-

try should pay a portion of the cost of treating their wastes at a municipal plant. Many formulae have been used so as to make the charges fair to industry and the individual. Since the plant operator is not concerned with formulating charges, this subject will not be discussed. However, since he may be asked for advice on sewer ordinances we would recommend as a beginning, that he become familiar with the "Manual of Practice" No. 3 of the F.S.I.W.A.[17]. Although this was published in 1949, it is still a good model from which to work. To get the feeling of ordinances and their need, an operator might read the "Industrial Waste Forum"[18] and an article by Eldridge on industrial wastes[19].

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Unique Electronic Push-button Control System

A $432,000 contract awarded to the General Electric Communication Products Department will provide an intricate electronic pulsing system designed to permit more effective operation of Philadelphia's huge, complex water system.

Water Department Commissioner, Samuel S. Baxter said General Electric will create the framework for the system, which will make it possible for employees at a Water Department central control point to know instantly the pressure, level, rate of flow, etc., of water anywhere in the water system and to take corrective action in emergency situations.

At the present time, the vital information is transmitted by telephone to the department's headquarters in an annex to Philadelphia's City Hall and manually logged for the department's records.

Eight microwave stations will furnish the communications link permitting the load control center, being established at 29th and Cambria Streets, to collect information from 92 points in the city where measurements are made on reservoir levels, water pressure, and the flow of water through municipal lines.

Electronic pulses from each of the 92 points will be telemetered continuously and sent via microwave to the control center. There, a data logger will convert the pulses to digital information.

A logging printer will permit the transfer of coded information automatically to a typewriter in numercial form for the department's permanent record.

The new integrated system also includes a punched-tape feature which enables the office to isolate certain portions of the information for detailed study, without interfering with the data automatically logged on permanent records.

Water Department attendants at the center may keep constantly informed of line conditions. Any time a reading is abnormal — either higher or lower than it should be—visual and audio alarms will go into action.

Signals will be transmitted continuously from all stations at the rate of one per second — thus giving a complete readout at headquarters on the whole system every minute and a half.

An advantage of the system is that high and low "fault" limits can be fixed for each of the 92 field reporting points. Such faults as pressure drops in the distribution mains, rise in river height, or unusual change in pumping operations will be known instantly at headquarters through the alarm system.

In the case of the four supervisory-controlled pumping stations, the operator on duty will then put the center's supervisory controls to work to automatically lessen difficulties caused at the point where trouble has occurred. If the situation cannot be remedied completely by automatic control, such as in a line break, Water Department personnel will be dispatched immediately to the scene.

The department will have one operator on duty at the load control center at all times, together with a chief load control dispatcher who will coordinate the operation of the system. These men will be selected from departmental employees and given special training.

The Commissioner said that the load control system is being designed to make future expansion simple. Such expansion will include not only more reporting points and further spervisory control, but also voice channels for radio dispatch and telephone communications.

The plan also will permit future automation, when that becomes feasible. Baxter said automation is some distance off, but when it comes, automatic equipment, rather than an operator, will observe the changes in the water system and start pumps or take other action as necessary.

Something's happening on the Ohio River with regard to municipal industrial waste control according to . . .

ORSANCO'S 10th Annual Report

EDITOR'S NOTE: For the 10th year, the Ohio River Valley Sanitation Commission has issued an optimistic and meaningful report. According to Edward J. Cleary, Executive Director and Chief Engineer of the Commission, this report "records accomplishments that have been inspired by a decade of dedicated effort among eight states in their regional crusade for clean streams. Ten years is a short time in a pollution-control program of the scope and magnitude of that presented in the Ohio Valley. But in this period the trend of half a century of river abuse has been reversed. The satisfaction this brings can be exceeded only by aspiration it creates for perfecting regional coordination of control procedures. To this end the signatory states are now pioneering in development of new concepts embraced in terms of river-quality management." Treatment facilities are now operating or under construction to serve 92 per cent of the sewered population, ten years ago it was less than 1 per cent. Seven out of every ten industries are complying at least with minimum requirements; ten years ago less than three out of ten were in this category.

■ On The Agenda of ORSANCO are several activities, some current, some proposed. Included are five proposals for the control of industrial discharges and one for the control of municipal sewage discharges. The latter concerns the Monongahela River, a major interstate tributary of the Ohio River. The industrial control proposals are in various stages of development. In all cases they are predicated on a Commission resolution directing the staff to make an investigation and to prepare a report on findings along with recommendations. Among the control proposals are: Chloride control, taste-and-odor control, oil control, mine-drainage control, toxicity control, and the Monongahela River study.

Water Quality Surveillance

"A systematic check on stream conditions is maintained through water-quality observations at 44 monitor stations. Nineteen stations are on the main-stem of the Ohio River and 25 are located on seventeen major tributaries. This monitor network, now in its seventh year of operation, is providing essential data to appraise pollution-abatement efforts and to guide the Commission in development of additional control measures.

"One-third of the monitor stations are operated on a volunteer basis by managers of public, private and industrial water-treatment plants who are organized as the Water Users Committee. Another third are operated under a cooperative agreement between the Commission and the U. S. Geological Survey. The remaining stations are serviced by the U.S.G.S. under cooperative arrangements with the various states. . . .

Robot-Monitor Project

"Basically, a pollution-control program is a problem in river-quality management. And for this purpose data on variations in quality should be continuously acquired and evaluated. During the past seven years the Commission has developed a network of manual monitor stations to secure quality data.

"Meantime, impetus has been given to imagineering a robot system for this purpose. The word imagineering may be defined as the process of combining ideas to devise something new; and robot is another coined word that is used to describe an automatic device. In brief, the Commission is seeking to devise a system for automatically analyzing, recording and transmitting data on quality conditions in the river.

"The purpose and desirability of such an undertaking can be appreciated by recalling that management of the Ohio River system involves a main stem almost 1,000 miles in length and into which drain 20 major tributaries.

"Initial efforts on the robot project were directed toward determining the availability and adaptability of automatic analytical equipment. In addition, possibilities for development of equipment not now available were outlined. During the past year several instruments have been under test at various locations. . . .

Radioactivity Monitoring

"By arrangement with several federal and state agencies who have established radioactivity monitor stations, the Commission is compiling a record of radiation levels in the Ohio River and its tributaries . . . These agencies now have in operation 70 monitoring stations throughout the Ohio Valley district (see location map in Ninth Annual Report).

"Stations have been located to determine background radiation from natural sources, detect radioactivity variations, and to monitor industries and research facilities where atomic material is processed or used. Samples at all locations are collected for analysis once or more monthly. . . .

"To sum up: On the basis of data collected during the past two years it is concluded that the radioactivity in the streams of the Ohio Valley district is well within limits defined by

radiological health experts. There is considerable fluctuation from time to time in radioactivity levels, with occasional widespread increases. The available data points to the need for more information on, and further investigation of, the suspended radioactivity that may be carried along as part of the streambed silt load. Such an investigation is now being conducted by the Commission under contract with the University of Louisville.

Aquatic-Life Resources Project

"Inventory and evaluation of the aquatic-life resources of the Ohio River has been underway since March 29, 1957. . . . A primary object of the project is to secure an appraisal of the suitability of the river for the maintenance of aquatic life and the production of a harvestable fish crop. . . .

"Efforts during the first year were directed toward determining the species composition, distribution and relative abundance of the various fishes. Sampling of fish population has been facilitated through the use of chemical treatment in the lock chambers at the navigation dams of the Ohio River and at tributary streams and backwaters; seines, nets and otter trawls have been used at other locations throughout the 981 miles of the river.

"Meantime, work has been proceeding on these additional phases of the project: Creel census, commercial fishing activities, museum collections, flavor-testing and limnological investigations. . . .

Taste-and-Odor Study

"In April 1957 the Commission contracted with The Kettering Laboratory of the University of Cincinnati for systematic examination of Ohio River samples with a view toward identifying substances contributing to taste-and-odor problems. A further objective of the project is to encourage development of improved techniques for analysis of those substances.

"The procedure followed thus far has involved the use of activated-carbon filters for adsorption of organic materials from water samples. A known volume of water is passed through the filter over a one-week period. Organic matter is then extracted from the carbon with a solvent, after which it is concentrated and subjected to chemical and physical analyses. . . .

The chemical and physical methods of analysis initially employed failed for the most part to yield consistent and reliable results. Therefore, new methods of identification were investigated. . . .

"After some preliminary testing, the gas chromatographic procedure was found to be sufficiently sensitive for detecting some phenolic materials, and this technique was adopted for the routine examination of the organic material recovered from the water samples. Attention is being given initially to the phenolic compounds, since some of these are known to contribute taste-and-odor when present in very low concentrations. . . .

"Findings thus far lead the Kettering investigators to reach the following general conclusions: 'No single compound or class of compounds can be used as a reliable indicator of the need for treating water supply in order to reduce the odor and taste.'" . . .

Membrane Filter Adopted

"Bacterial quality of Ohio River water is now being measured by a simpler, quicker and more precise means. Acting on findings from a comparative bacteriological study carried out with the aid of its Water Users Committee, the Commission adopted in January 1958 the membrane-filter (MF) technique as optional procedure to the orthodox most probable numbers (MPN) method for determining bacterial content of river water. Approval for use of the new technique has been granted by several of the signatory states to Ohio River water-plant laboratories where ability to perform the test has been demonstrated. . . .

"In view of the apparent practical advantages of the MF technique, the staff recommended Commission sponsorship of a comparative study with the 40-year-old MPN method to determine the adaptability of the new procedure for water-quality monitoring. With the cooperation of members of the Water Users Committee, who made available certain facilities and personnel, the Commission found it possible to sponsor this investigation at a nominal cost. The total cost to date for supplies and materials has been $4,500.

"Evaluation of the first twelve months of test data by staff consultant Harold W. Streeter led to the following findings:

The MF technique is adaptable to conditions experienced in Ohio River water plants.

The MF procedure is much simpler than that for the MPN test; however, considerable practice in conducting the MF test is needed to acquire the necessary skill for identifying and counting the coliform colonies.

MF counts are more precise than those of MPN and consequently they appear to offer more accurate enumeration of coliform density.

MF results are obtained within one day, whereas the MPN method takes two or more days to complete and obtain results.

Overall operating costs, including labor, for conducting the MF test will range from about the same to one-third less than the cost for the MPN test. . . .

Scoreboard

Details on pollution control for the 155,000 sq mi area that comprises the Ohio River drainage basin are summarized as follows.

"*Municipal Status*—Sewage-treatment facilities are now in operation or under construction to serve 8,095,000 people—this represents 79 percent of the total sewered population (10,226,000). Ten years ago sewage-treatment facilities were provided for only 3,150,000 people.

"Of the 1,574 communities that are sewered in the Ohio Valley, treatment facilities for 881 are in operation or under construction. Meantime, 180 communities have had final plans approved for early construction. The discharge from another 177 communities (in which the average population is less than 850) is considered of minor pollutional significance. Details for each signatory state on the status of its communities are shown in the tabulation on the opposite page, along with a comparative summary.

"*Industrial Status*—Of the 1,459 industries whose effluents are discharged directly into streams 54 percent are now provided with control facilities that are rated adequate by the signatory states. Five years ago (complete records were not available prior to this time) only 26 percent of the 1,247 industries were in this category.

"Details for each of the eight states are given in a tabulation titled 'Status of Industrial-Waste Control Facilities.'"

The Editor's Comments

Water Resources Research

In the lead article of this issue, we have published a story of 50 years of operations of the Illinois State Water Survey. This review is presented at this time in conjunction with the commemoration of the 50th anniversary of the founding of the Illinois Section of AWWA. Last year the Indiana Section had its 50th anniversary and other sections will soon celebrate their 50th anniversaries, but what makes this particular commemoration in Illinois of interest to us, is the part that the Illinois Section has played in that unique research organization, the Illinois State Water Survey, and vice versa. During the past five decades, 12 of the Chairmen of the Section have been staff members of the Illinois Water Survey.

Fifty years of research in the field of water resources and sewage treatment by this organization has contributed much to the general knowledge in the field of sanitary engineering as well as much to specific information of benefit to the people of the State of Illinois. We are happy to salute both the Illinois State Water Survey and the Illinois Section of AWWA.

Water Works Management

Also in this issue, there appears Part II of a report on the Illinois Section Short School on Management. We recommend it for interesting and helpful reading.—And, as we did last month, we recommend that our readers plan to attend this short school next October.

In this issue, too, we present Part I of a three part Symposium on Management. This symposium is a collection of nine articles (three in this issue) which were presented at the annual meeting of the Penna. Water Works Assn. We feel fortunate to have obtained permission to publish this series and we recommend the series as "homework" for all persons engaged in management jobs, either in water supply or sewage works.

A Point to Ponder

The population boom—That is a point to ponder! Within recent months, the U. S. Census Bureau released a prediction of both liberal and conservative estimates for the future population of this country, as follows:

Year	Population Estimate—Millions	
	Conservative	Liberal
1960	179.4	181.2
1965	191.5	199.2
1970	202.5	219.5
1975	215.8	243.9
1980	230.8	272.6

Whereas previous projections had indicated from 220 to 255 million by 1980, the present projection indicates a population of 231 to 273 million by 1980. Thus we may expect our total population to increase by 56 to 93 million persons in the next 22 years.

Why this population explosion?—For one thing, the cold war has spurred marriage. For another, whereas the birth rate in 1935 was 16.9 per 1000 in the U. S., in 1955 it was 24.6 and is about the same now. And still another factor—the infant mortality rate has been reduced markedly and the life expectancy continues to increase.

Where will this population boom be felt? Estimates indicate:

Areas	Expected Increase
3 Pacific States	51%
8 Mountain States	44%
5 East No. Central States	32%
9 So. Atlantic States	28%
3 Middle Atlantic States	21%
7 West No. Central States	16%
6 New England States	16%
4 East So. Central States	5%

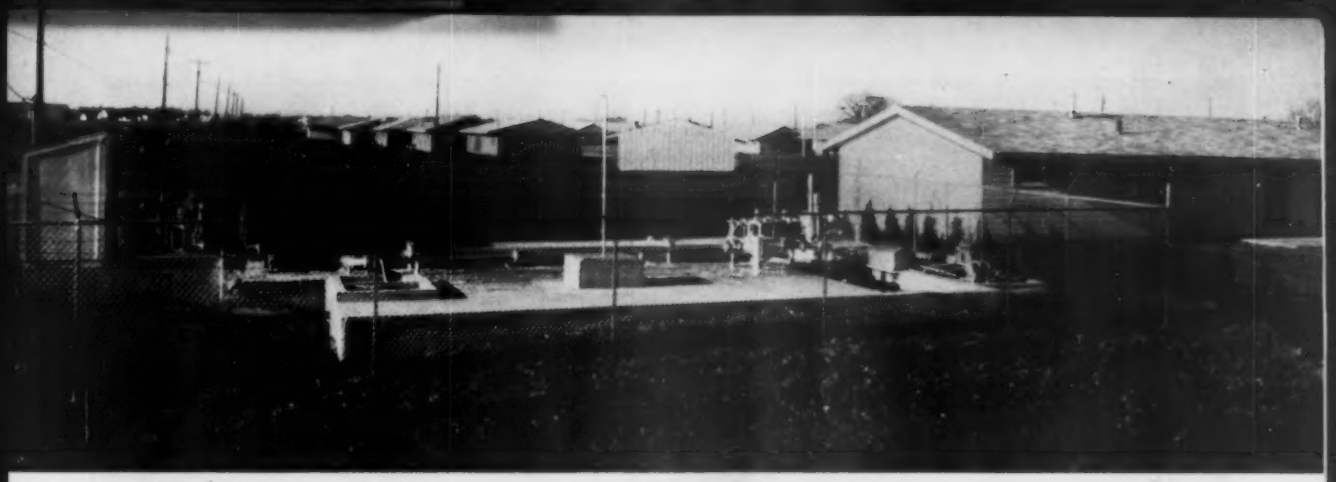
What does this population growth mean?—It means more public works, more schools, more highways, more water facilities, and more sewage works.

By 1980, for each person, we shall have to provide water at an average rate of 175 to 200 gcpd—and sewage treatment facilities to handle that volume. When these population and consumption increases are projected into the future, it may be calculated that each year in the next 20 years, we will need to add water supply and sewage treatment facilities sufficient to handle from 708 to 1,416 mgd. At the present time we are not building at that rate and the backlog continues to grow.

What are other effects of this population boom?—By 1980 there will be 32 cities, now under 50,000 population, that will grow to metropolitan size; there will be 200 metropolitan areas with a total population of 150 million persons. Also we shall see the development of the megalopolis, or metropolitan areas that have coalesced into built-up areas 600 miles or so in length. And there will be other strip cities along the superhighways. To serve these strip cities will present problems of long distribution lines and intercepting sewers or multiple smaller water supplies and sewage plants.

What does all this mean to you?—It means that you should take a long hard look at your future planning for the next 20 years. In the words of AWWA past president Wendell LaDue of Akron, Ohio, "In this business, ten years from today is NOW!"

George E. Symons.



SUBDIVISIONS
German View Subdivision, Perrysburg, Ohio
Design Flow—30,000 G.P.D.
Approx. Plant Area—40 x 60 Feet

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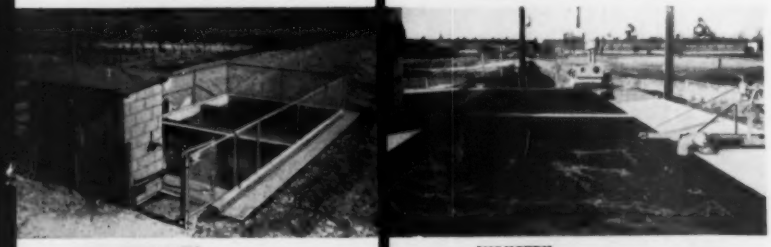
Small Unit Sewage Treatment Process Equipment for 20 to 5,000 People

SCHOOLS
Kennedy School, Louisville, Kentucky
Design Flow—7,500 G.P.D.
Approx. Plant Area—20 x 30 Feet

SHOPPING CENTERS
Westgate Shopping Center, Lima, Ohio
Design Flow—15,000 G.P.D.
Approx. Plant Area—30 x 30 Feet



MUNICIPALITIES
Valley Springs, California
Design Flow—40,000 G.P.D.
Approx. Plant Area—30 x 45 Feet

INDUSTRY
B. F. Goodrich Co., Oaks, Pennsylvania
Design Flow—56,000 G.P.D.
Approx. Plant Area—35 x 55 Feet

CONVENTS
Ancilla Domini-Villa Maria—Donaldson, Indiana • Design Flow—40,000 G.P.D.
Approx. Plant Area—30 x 45 Feet

HOSPITALS
Tuberculosis Hospital, Lima, Ohio
Design Flow—20,000 G.P.D.
Approx. Plant Area—26 x 28 Feet

Features

- Odor free
- Nuisance free
- Lowest cost sewage treatment
  - Low original cost
  - Low cost sewer lines . . . plant located within subdivision
  - Low operating and maintenance costs
  - Economically expendable . . . for area planning of future sewage systems
  - Small, compact plant area
  - Centralization means more homes per acre
- Expandable—by multiple units
- Exclusively successful standardized balanced equipment
- Applicable in steel or concrete units

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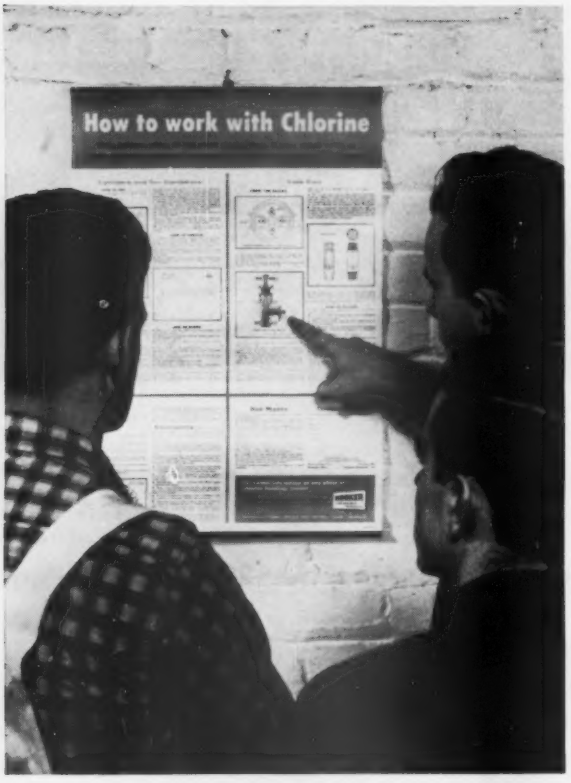

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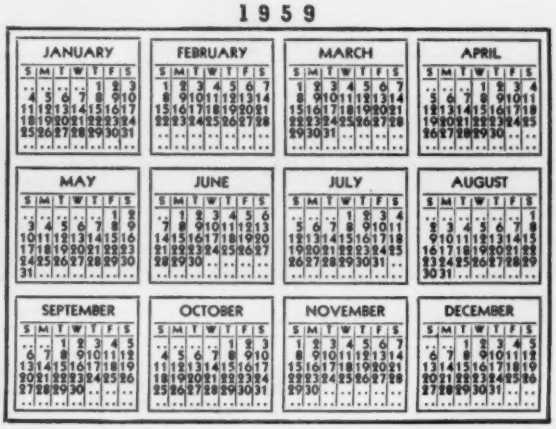
Meetings

1959



Mar. 2-13—Cincinnati, Ohio (*R. A. Taft San. Engrg. Center*)
SHORT COURSES ON WATER QUALITY MANAGEMENT. Chief Training Program, R. A. Taft Sanitary Engrg. Center, 4676 Columbia Parkway, Cincinnati 26, Ohio

Mar. 2-6—College Station, Texas (*A & M College*)
TEXAS WATER & SEWAGE WORKS ASSN., Annual Short School, Secy., V. M. Ehlers, 2202 Indian Trail, Austin 3, Texas

Mar. 6—Jackson, Miss. (*Robt. E. Lee Hotel*)
MISSISSIPPI SEWAGE & IND. WASTES ASSN., Secy., Neil G. McMahon, Mississippi State Bd. of Health, Jackson, Miss.

Mar. 10-11—Atlantic City, N. J. (*Hotel Traymore*)
CONF. ON SOLIDS SEPARATION FROM GASEOUS & LIQUID INDUSTRIAL WASTES, Mid-Atlantic States—APCA Section Hdqtrs., Dept. of Sanitation, Rutgers State University, New Brunswick, N. J.

Mar. 11-13—Chicago, Ill. (*Morrison Hotel*)
ILLINOIS SECTION, A.W.W.A., Secy., Dewey W. Johnson, Cast Iron Pipe Research Assn., Suite 3440 Prudential Plaza, Chicago 1, Ill.

Mar. 1-13—Atlantic City, N. J. (*Traymore Hotel*)
NEW JERSEY SEWAGE & INDUSTRIAL WASTES ASSN., Secy., Anthony T. Leahey, P. O. Box 32, West Trenton 8, N. J.

Mar. 16-18—Little Rock, Ark. (*Marion Hotel*)
ARKANAS WATER & SEWAGE CONF., C. W. Oxford, Univ. of Arkansas, Fayetteville, Ark.

Mar. 18-20—Baton Rouge, La. (*Louisiana State Univ.*)
22ND ANNUAL SHORT COURSE FOR SUPTS. & OPERATORS OF WATER AND SEWAGE SYSTEMS, Fred H. Fenn, Dean, Coll. of Engrg. and Director Engrg. Exp. Station, Louisiana State Univ., Baton Rouge, La.

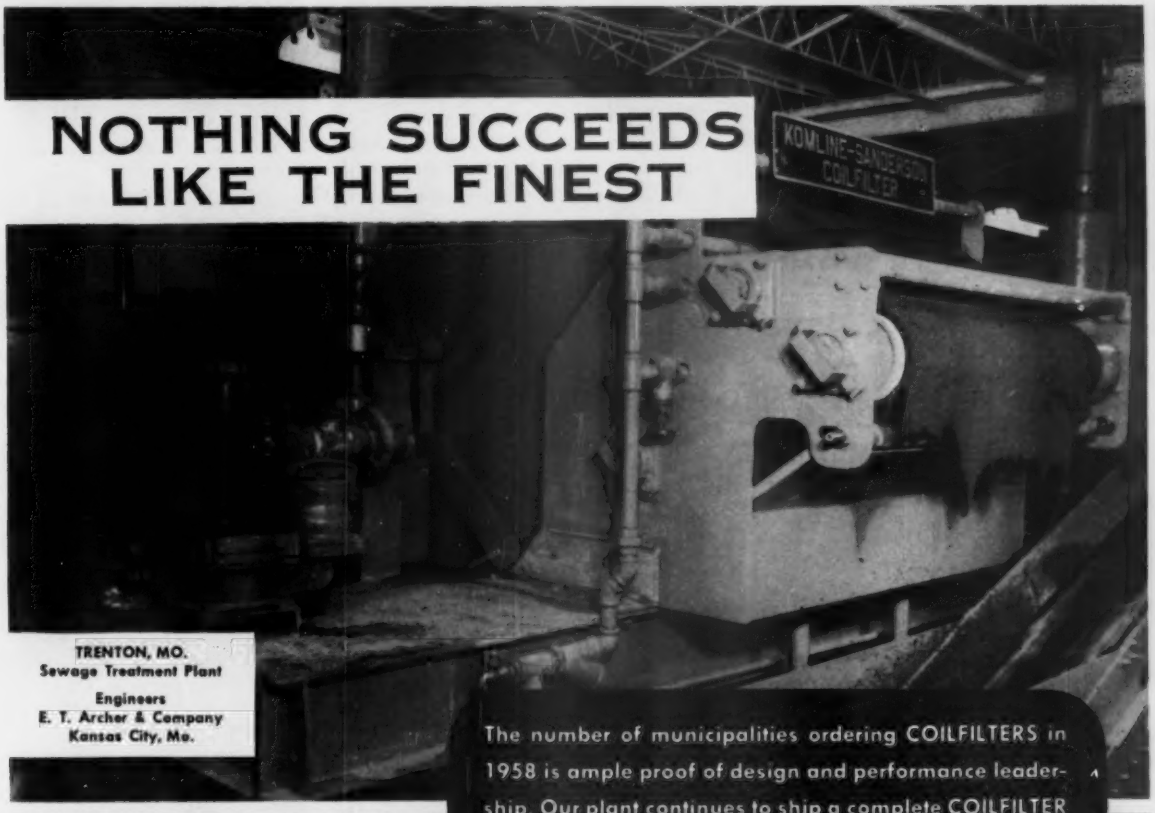
Mar. 19—Boston, Mass. (*Statler Hotel*)
NEW ENGLAND SECTION, A.W.W.A., Secy., J. E. Revelle, Chicago Bridge & Iron Co., 201 Devonshire St., Boston 10, Mass.

Mar. 19—Boston, Mass.
NEW ENGLAND WATER WORKS ASSN., Secy., Joseph C. Knox, 73 Tremont St., Boston, Mass.

Apr. 2-3—Chapel Hill, N. C. (*Univ. of North Carolina*)
EIGHTH SOUTHERN MUNICIPAL & IND. WASTE CONF., Prof. Dan A. Okun, Univ. of North Carolina, Chapel Hill, N. C.

CONTINUED ON PAGE 94A

NOTHING SUCCEEDS LIKE THE FINEST



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Engineers
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Whitemarsh, Penna.
Baden, Penna.
Marceline, Mo.
Omaha, Neb.
Manitowoc, Wis.
Superior, Neb.
Ogallala, Neb.
Regina, Canada
Kiamesha Lake, N. Y.
Jonesboro, Ark.
Holdrege, Neb.
Boone, Iowa
Toronto, Canada
North Toronto STP
Makena, Ill.
Fairbury, Neb.
Somerset-Raritan Valley
Sewerage Authority,
Somerville, N. J.
Martin, Tenn.
Rochester, N. Y.
Muskegon, Mich.
Spring Valley, Ill.
Poughkeepsie, N. Y.
Burlington, Iowa
Weirton, W. Va.
New Albany, Ind.
East Lansing, Mich.
Willowbrook State School
Staten Island, N. Y.
Brantford, Canada
Little Rock, Ark.
Madeira Beach, Fla.
Thompson, Canada
Burlington, Vt.
Tonawanda, N. Y.
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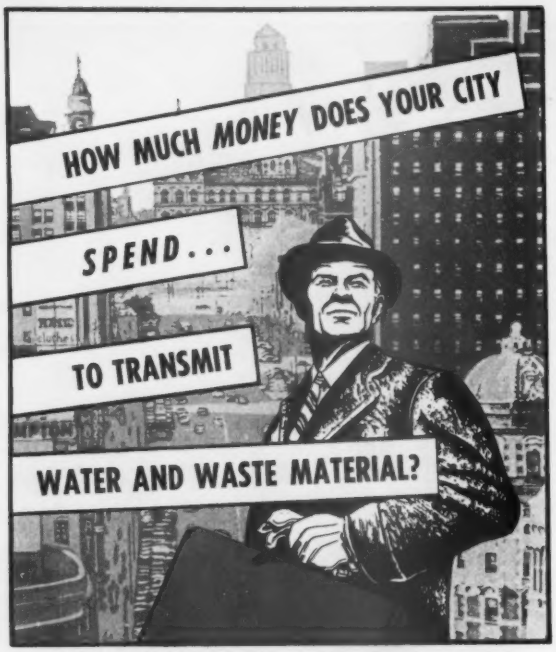

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SWP-26

Apr. 2-3—Seattle, Wash. (*Univ. of Washington*)
9TH PACIFIC NORTHWEST INDUSTRIAL WASTE CONFERENCE, Prof. Robert O. Sylvester, Dept. of Civ. Engrg., Univ. of Washington, Seattle 5, Wash.

Apr. 5-8—Columbia, S. C. (*Wade-Hampton Hotel*)
SOUTHEASTERN SECTION, A.W.W.A., Secy., N. M. de Jarnette, State Dept. of Public Health, 309 State Office Bldg., Atlanta 3, Ga.

Apr. 5-10—Cleveland, Ohio (*Public Auditorium*)
5TH NUCLEAR CONGRESS sponsored by AWWA and other Societies, T. A. Marshall, Jr., Mgr., 1959 Nuclear Congress, c/o Engineers Joint Council, 29 W. 39th St., New York 18, N. Y.

Apr. 5-10—Boston, Mass.
135TH NATIONAL MEETING AMERICAN CHEMICAL SOCIETY, Secy., H. B. Gustafson, P. O. Box 5033, Tucson, Ariz.

Apr. 6-8—Pullman, Wash. (*State College of Washington*)
SIXTH BIENNIAL INLAND EMPIRE SEWAGE WORKS SHORT SCHOOL, Prof. G. H. Dunstan, State College of Washington, Pullman, Wash.

Apr. 8-10—Rochester, N. Y. (*Powers Hotel*)
N. Y. SECTION, A.W.W.A., Secy., Kimball Blanchard, 19 W. 50th St., New York 20, N. Y.

Apr. 9—Bangor, Maine
MAINE WATER UTILITIES ASSN., Secy., G. F. Laurin, 89 Western Ave., Augusta, Maine

Apr. 9-11—Glendive, Mont. (*Jordan Hotel*)
MONTANA SECTION, A.W.W.A., AND MONTANA SEWAGE & INDUSTRIAL WASTES ASSN., Joint Meeting, Secy., Arthur W. Clarkson, State Board of Health, Helena, Mont.

Apr. 13-14—Luray, Va. (*The Mimslyn*)
VIRGINIA INDUSTRIAL WASTES & SEWAGE WORKS ASSN., Secy., O. J. Hand, c/o Hercules Powder Co., Hopewell, Va.

Apr. 15-17—Lincoln, Neb. (*Cornhusker Hotel*)
NEBRASKA SECTION, A.W.W.A., Secy., Rupert C. Ott, Jr., Neptune Meter Co., 2818 - 21st St., Columbus, Nebr.

Apr. 16-18—Phoenix, Ariz. (*Hi-Way House Hotel*)
ARIZONA SECTION, A.W.W.A., Secy., Stanford I. Roth, Div. of Water & Sewers, Phoenix, Ariz.

Apr. 22-24—Pittsburgh, Kansas (*Besse Hotel*)
KANSAS SECTION, A.W.W.A., Secy., Harry W. Badley, Neptune Meter Co., 119 West Cloud, Salina, Kan.
(Jointly With)
KANSAS SEWAGE & INDUSTRIAL WASTES ASSN., Secy., James F. Aiken, Jr., 1900 East Ninth, Wichita, Kan.

Apr. 23-25—Vancouver, B. C. (*Vancouver Hotel*)
PACIFIC NORTHWEST SECTION, A.W.W.A., Secy., Fred D. Jones, W. 2108 Maxwell Ave., Spokane 11, Wash.

Apr. 24—Reading, Pa. (*Abraham-Lincoln Hotel*)
PENNA CLEAN STREAMS CONFERENCE sponsored by Pa. State Chamber of Commerce.

Apr. 29-May 2—Long Beach, Calif. (*Hotel LaFayette*)
CALIFORNIA SEWAGE & INDUSTRIAL WASTES ASSN., Secy., Alfred Leipzig, 12000 Vista Del Mar, Venice, Calif.

May 3-6—Montreal, Can. (*Queen Elizabeth Hotel*)
CANADIAN SECTION, A.W.W.A., Secy., Dr. A. E. Berry, 72 Grenville St., Toronto, Ont. Can.

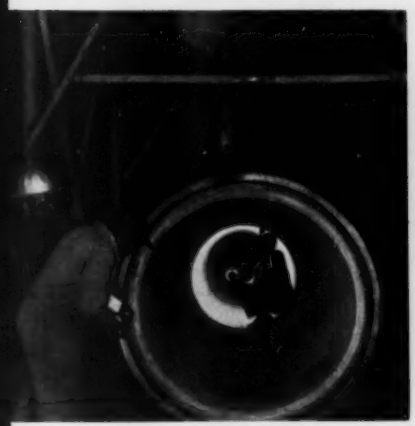
May 5-7—Lafayette, Ind. (*Purdue University*)
14TH PURDUE INDUSTRIAL WASTE CONF., Chairman, Prof. Don E. Bloodgood, Purdue University, Lafayette, Ind.

CONTINUED ON PAGE 96A

1. Straddle carrier brought this piece of pipe 1½ miles through tunnel. Will back out for next piece.

2. Lubricated rubber gasket stretched over steel gasket ring on spigot end of concrete cylinder pipe.

3. Special rig supports new section as pull-jack completes joint. Side jacks handle horizontal alignment.



4. Inside man checks joint tolerances with gauge, as outside man cleans steel joint ring at bell end.

5. Wye section hauled in flat and jacked to vertical position; will take off through tunnel wall, right.

6. Bucket on high lift chutes across installed section to pour cradle for permanent support.

Workmen use new tricks to lay concrete steel-cylinder pipe in unused Cincinnati subway

The workmen who installed Cincinnati's new 48-inch water transmission line were faced with unusual problems, as 11,000 feet of the line's 14,000-foot length were inside an unused subway tunnel. The subway was built beneath Cincinnati's Central Parkway over 30 years ago, but because of changes in the city's growth pattern, was never used.

The above pictures were taken a mile and a half from the mouth of the tunnel. A single piece of pipe was hauled through the tunnel to the installation spot, then transferred to a special rig to be raised or lowered into vertical alignment. Jacks between the pipe and tunnel walls handled horizontal alignment. A pull-jack completed the joint, and timbers were used for temporary support until permanent cradles were poured.

Standard 16-foot lengths, with beveled ends, were used on curves. These units provided deflection up to 4 degrees at the joint. Minor changes in alignment were handled by "cracking" the steel-and-rubber joint of standard-end pipe as much as one half inch.

According to Charles M. Bolton, Supt. of Water Works, concrete steel-cylinder pipe was selected for this job because it would provide high initial, and high ultimate capacity; because it could be expected to give long service with a minimum of maintenance; and because the flexible, rubber-gasket joint would handle the expansion and contraction resulting from greater temperature changes than would be experienced with a buried line.

Black and Veatch of Kansas City, consulting engineers, designed the line. Charles F. Smith and Son, Inc., of Kennett Square, Pa., were general contractors. Price Brothers Company of Dayton, Ohio and Hattiesburg, Miss., manufactured the pipe.

Price Brothers

May 4-8—Cleveland, Ohio (*Hotel Cleveland*)
AMERICAN SOCIETY OF CIVIL ENGINEERS, Exec. Secy., W. H. Wisely, 33 W. 39th Street, New York 18, N. Y.

May 13-14—Durham, N. H. (*Univ. of N. H.*)
NEW ENGLAND SEWAGE & INDUSTRIAL WASTES ASSN., Spring Meeting, Secy., Earl R. Howard, Bur. of Pub. Works, 115 Broad St., Hartford, Conn.

May 21—Manchester, N. H.
NEW ENGLAND WATER WORKS ASSN., Secy., Joseph C. Knox, 73 Tremont St., Boston, Mass.

June—Berkeley, Calif. (*Univ. of Calif.*)
FIRST INTERNATIONAL CONF. ON WASTE DISPOSAL IN MARINE ENVIRONMENT, Prof. Erman A. Pearson, San. Engr., Research Laboratory, Univ. of Calif., Berkeley 4, Calif.

June 3-5—Wernersville, Pa. (*Salem House*)
PENNSYLVANIA SECTION, A.W.W.A., Secy., L. S. Morgan, Chief, Mine Drainage Sec., 413 First National Bank Bldg., Greensburg, Pa.

June 4-6—Tuscaloosa, Ala. (*Univ. of Alabama*)
ALABAMA WATER & SEWAGE ASSN., *Secy.*, E. J. Finnell, Jr., University of Alabama, University, Ala.

June 11—York, Maine
MAINE WATER UTILITIES ASSN., Secy., G. F. Laurin, 89 Western Ave., Augusta, Maine

June 17-19—Cincinnati, Ohio (*Netherland Hilton Hotel*)
OHIO SEWAGE & INDUSTRIAL WASTES TREATMENT CONF., Secy., Cleamon E. Lay, Ohio Dept. of Health, 101 North High St., Columbus 15, Ohio

June 18—Wentworth, N. H.
NEW ENGLAND WATER WORKS ASSN., Secy., Joseph C. Knox, 73 Tremont St., Boston, Mass.

June 24-26—Minneapolis, Minn. (*Pick Nicollet Hotel*)
CENTRAL STATES SEWAGE & INDUSTRIAL WATES ASSN., Secy., Scott A. Linsley, P. O. Box 3598, Child Rd., St. Paul Minn.

July 12-17—San Francisco, Calif., (*Civic Auditorium*)
A.W.W.A., CONVENTION, Secy., Harry E. Jordan, A.W.W.A., 2 Park Ave., New York 16, N. Y.

July 12-17—San Francisco, Calif., (*Civic Auditorium*)
CALIFORNIA SECTION, A.W.W.A., In Conjunction with National Convention, Secy., Roy E. Dodson, Jr., San Diego Water Dept., Balboa Park, San Diego 1, Calif.

Aug. 12-14—University Park, Pa. (*Pa. State University*)
PENNSYLVANIA SEWAGE & INDUSTRIAL WASTES ASSN., Secy., J. R. Harvey, 996 S. Main Street, Meadville, Pa.

Aug. 13—Vinal Haven, Maine
MAINE WATER UTILITIES ASSN., Secy., G. F. Laurin, 89 Western Ave., Augusta, Maine

Sept. 2-4—Huron, So. Dak. (*Marvin-Hughitt Hotel*)
SOUTH DAKOTA WATER & SEWAGE WORKS CONF., Secy., Don C. Kalda, Pierre, So. Dak.

Sept. 7-9—Jackson, Wyoming (*Jackson Lodge*)
ROCKY MOUNTAIN SEWAGE & INDUSTRIAL WASTES ASSN., Secy., Verne E. Plath, P. O. Box 149, Englewood, Colo.

Sept. 9-11—Milwaukee, Wis. (*Hotel Schroeder*)
WISCONSIN SECTION, A.W.W.A., Secy., Harry Breimeister, City Engrs. Office, City Hall, Milwaukee 2, Wis.

Sept. 13-18—Atlantic City, N. J.
136TH NATIONAL MEETING AMERICAN CHEMICAL SOCIETY, Secy., H. B. Gustafson, P. O. Box 5033, Tucson, Ariz.

AUTOMATICALLY CONTROL YOUR PUMPS

Preset

- LENGTH OF TIME
- TIME OF DAY OR NIGHT
- DAYS OF THE WEEK
- ON OR OFF HOURS
- SKIP DAYS

Synchro-Start AUTOMATICALLY will start and stop your pumping engine during any periods you require.

This control uses no commercial current as it operates from the engine's battery. The cabinet is double weather-proof and has knockouts for conduit wiring.

Write for Detailed Information

Please include all pertinent data regarding the installation and the engine you wish equipped.

SYNCHRO-START PRODUCTS, INC.
Since 1932
[illegible] NORTH RIDGEWAY AVENUE • SKOKIE, ILLI[illegible]

Tops in Everything

CONVENIENT

Member Diners' Club

Ideally located in St. Louis, two short blocks from the Union Station and in the center of the Wholesale District . . . Preferred, always by experienced travelers because of its outstanding advantages— Every room with combination tub and shower . . . and circulating ice water. Delicious food . . . cheerful service.

AIR-CONDITIONED ROOMS

350 rooms from $3.50

HOTEL LARIDGE

ERNIE SIMONS General Manager

LOCUST ST. AT EIGHTEENTH

Free Parking

ST. LOUIS

Aqueduct, 105 B. C.

Cathedral, 1065

Fountain, 1650

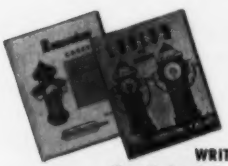
Ludlow Hydrant, 1883

SO WELL-MADE

they're still in use!

In a sense, Ludlow and Rensselaer fire hydrants are among the great man-made objects. They're built to *last*. All Ludlow and Rensselaer hydrants are made to stay on the job through years of rough treatment and rigorous climate —never quitting!

Developed through nearly 100 years of practical experience, Ludlow and Rensselaer hydrants have *earned* their title of "watchdogs of American property." Without exception, they give you the 4 basic requirements for hydrant performance: simplicity of design, absolutely tight closure, no freezing and no flooding due to standpipe breakage.



WRITE TODAY for L&R Fire Hydrant Catalogs showing a model for every need.

LUDLOW & RENSSELAER
VALVES AND HYDRANTS

THE LUDLOW VALVE MANUFACTURING CO., INC., TROY, N.Y.—SINCE 1861

There's no waste water from a V-notch

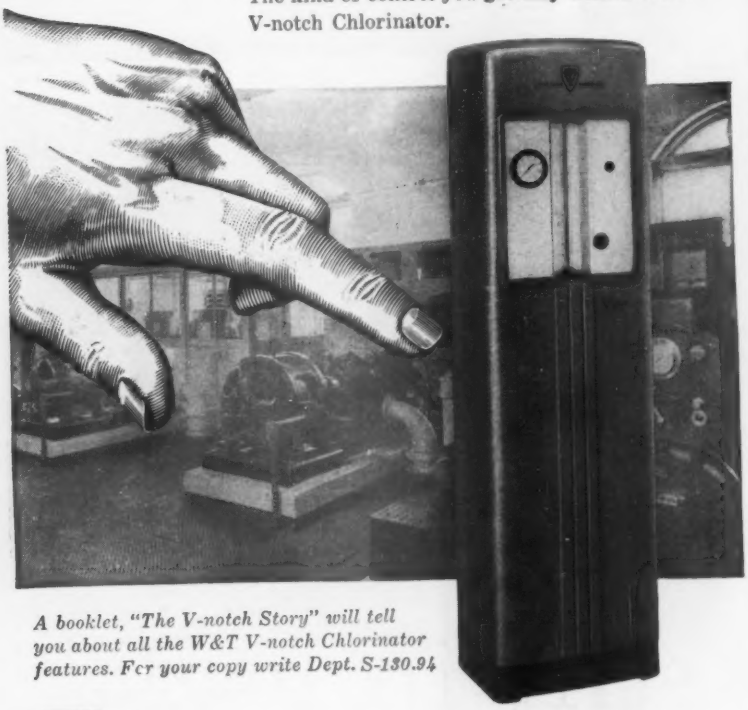
Why?

Because a V-notch Chlorinator needs no auxiliary water supply.

You can plan on clean, dry chlorinator rooms with no messy drain—no chlorine gassing back. And best of all... gone forever is the high cost of wasted auxiliary water.

And, of course, the right plastics make the whole chlorinator chlorine-proof.

Yet these are just added benefits to the main job: Simple, dependable, wide range chlorine control. The kind of control you get only with a W&T V-notch Chlorinator.



A booklet, "The V-notch Story" will tell you about all the W&T V-notch Chlorinator features. For your copy write Dept. S-130.94

WALLACE & TIERNAN INCORPORATED
25 MAIN STREET, BELLEVILLE 9, NEW JERSEY

W&T DRY CHEMICAL FEEDERS

For Accurate Feeding Of Water Treatment Chemicals

Full line of wide range dry chemical feeders capable of controlling a few ounces to 3000 lbs. per minute.

Write for Bulletin M-38 for complete Dry Feeder information.

WALLACE & TIERNAN INCORPORATED
25 MAIN STREET, BELLEVILLE 9, NEW JERSEY

News of Suppliers

Simplex Appoints Hultz "Casey" Jones Retires

Permutit Division, Pfaudler Permutit Inc., New York, N.Y., has announced the appointment of Mr. J. M. Hultz to the position of General Manager of Simplex Valve & Meter Co., a subsidiary. He replaces Mr. E. M. "Casey" Jones, who resigned.

Mr. Hultz joined the Pfaudler Co. in June 1952 as a staff assistant for Special Engineering Problems in the Elyria, Ohio plant. In March, 1955, he moved to the Rochester, New York office as a general staff assistant and became staff assistant to the Executive Vice President in January, 1957. Mr. Hultz came to Simplex in March, 1958 as assistant General Manager.

Gannon Elected V.P. Mueller Co.

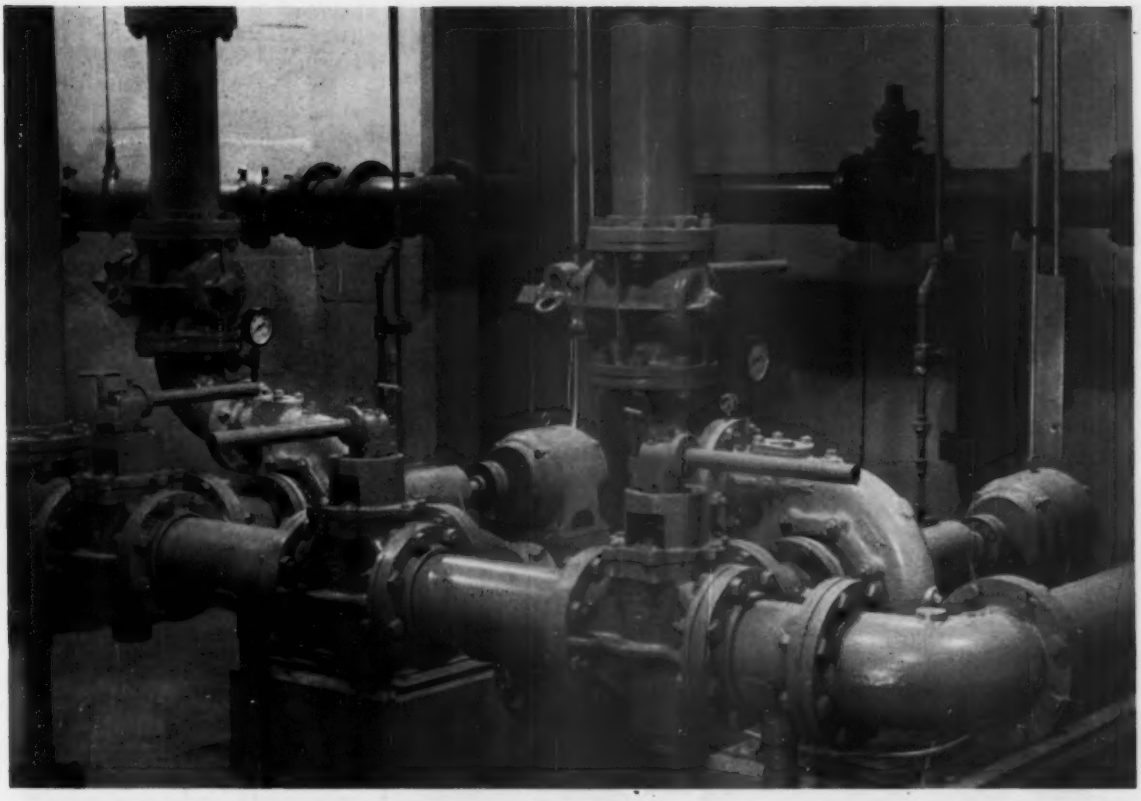
Mueller Co., Decatur, Illinois, has announced the election of Dan R. Gannon to the position of vice-president and general sales manager. Gannon has served as general sales manager since December, 1957.

He joined Mueller Co. in 1929 as a sales representative. In 1953, he became southwest sales manager, with headquarters in Dallas, and in 1955, was appointed western sales manager, with offices in Los Angeles. Gannon returned to Decatur in April, 1957, to assume the position of field sales manager, and served in that capacity until December of that year.

Worthington Promotes Karassik

Worthington Corp., Harrison, N. J. has just announced that I. J. Karassik has been appointed Consulting Engineer and Manager of Planning. Formerly Consulting Engineer and Assistant to Vice-President, Mr. Karassik will act as Consulting Engineer to all departments

CONTINUED ON PAGE 100A



LINE-TAMERS at Iowa City!

Valves in service on sludge lines take punishment that causes failure quickly in ordinary valves. But these DeZurik Valves are taming sludge lines and saving money in several ways at Iowa City Sewage Treatment Plant (Consulting Engineer: Stanley Engineering Co., Muscatine, Iowa; General and Mechanical Contractor: Red Ball Engineering and Development Co., Iowa City; Superintendent: Mel F. Neuzil).

First, these are DeZurik Multi-Ports, three-way valves that effect savings by simplifying piping layouts and reducing valve expense. A DeZurik three-way valve can take the place of two or three straight-way valves and eliminate complicated and expensive piping.

Second, DeZurik Valves require no maintenance! They last and last on the toughest service.

And, as always, DeZurik Valves close tight, open easily—without lubrication, without binding! The segmental plug cannot "trap" liquids in the plug to freeze or ferment when the valve is closed.

DeZurik Valves are manufactured in straight-way, three-way or four-way models, and with manual or remote operation. See the DeZurik representative in your area or write for details.

DeZURIK CORPORATION
SARTELL, MINNESOTA

News of Suppliers

CONTINUED FROM PAGE 98A

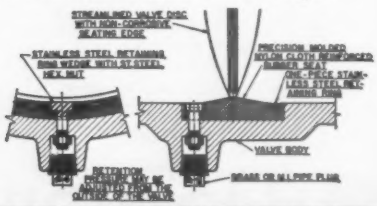
in the Harrison Division in his new assignment.

A graduate of Carnegie Institute of Technology where he obtained B.S. and M.S. degrees, Mr. Karassik joined Worthington in 1934 as Assistant to the Consulting Engineer on centrifulgal pumps and was assigned to design and research work. He later was named Manager of the Multistage Pump Section in the Centrifugal pump Department and in 1956 was appointed Consulting Engineer and Assistant to Vice President.

A top flight specialist on centrifugal pumps, Mr. Karassik has written about 600 articles on the subject which have appeared in the technical publications in six languages: English, Russian, Spanish, French, Italian and Swedish.

Mr. Karassik is a licensed Professional Engineer in the State of New Jersey and is a member of Sigma Xi, Tau Beta Pi and Pi Tau Sigma, national honorary engineering societies. He is also a member of the American Society of Mechanical Engineers.

This unique construction allows seat retaining pressure to be adjusted externally with the valve in place in the pipe line. Only two seat retaining screws are utilized which are not in contact with the flowing medium, minimizing erosion and corrosion of the seat retaining mechanism. Eliminates the need for numerous small seat retaining screws inherent in most available valve designs.


STREAMLINED VALVE DISC WITH NON-CORROSIVE SEATING EDGE
STAINLESS STEEL RETAINING RING WEDGE WITH ST STEEL HEX NUT
PRECISION MOLDED NYLON CLOTH REINFORCED RUBBER SEAT
ONE-PIECE STAINLESS STEEL MECHANISM RING
VALVE BODY
GRADE OR M.I. PIPE PLUG

Built in accordance with applicable AWWA specifications, Leopold Standard Butterfly Valves are available for line sizes 4"—48", with a choice of manual or various types of automatic operators.

Write today for Bul. No. 5603.58

F. B. LEOPOLD COMPANY
ZELIENOPLE PA.

EXCLUSIVE CANADIAN REPRESENTATIVE: W. J. WESTAWAY, LTD., HAMILTON, ONTARIO

Executive Changes At Lock Joint

Lock Joint Pipe Company, East Orange, N. J., has announced several executive changes in the company.

Mr. Phillip R. Hirsh, formerly Executive Vice President, in charge of sales, has been appointed Chairman of the Board of Directors.

Mr. C. Mack Alberton, former District Sales Manager out of the company's Turner, Kansas, Plant, has returned to the home office and appointed Sales Manager for Pressure Pipe Sales. His position at Turner, Kansas, was filled by Charles A. Gallagher.

Other changes announced were: Mr. Stephen L. Bartholomew, formerly Sales Representative from the home office, has been named Eastern District Sales Manager for Pressure Pipe; and Mr. Robert E. Bald, former Assistant Chief Engineer, has been named Chief Engineer for the company.

Ionics, Permutit, England Sign Licensing Agreement

Ionics, Incorporated, of Cambridge, Mass., USA and the Permutit Company, Ltd., of London, have signed a licensing and royalty agreement that is expected to speed the wide-spread application of membrane-type water desalting plants throughout the arid regions of the world.

Permutit Company, Ltd., (no corporate connection between Permutit Company, Ltd., of London and the U.S. firm, Pfauder-Permutit, Inc.) is one of the world's largest and oldest water treatment equipment organizations and becomes Ionics' licensee for the manufacture and sale throughout most of the British Commonwealth of ion exchange membranes and equipment covered by Ionics' British patents.

The agreement is expected to have

CONTINUED ON PAGE 102A

THE U. S. TREASURY SALUTES THE AUTO INDUSTRY

—and its thousands of employees who help strengthen America's Peace Power by buying U.S. Savings Bonds

The huge team that plans, builds and markets the cars America drives is making another great contribution to our national security. Thousands upon thousands of auto industry employees are buying U. S. Savings Bonds, regularly, through the Payroll Savings Plan.

Regular purchase of Shares in America helps these forward-looking people set up their own reserves for home building, for education and for greater security after retirement. The Payroll Savings Plan provides a sound, automatic way to practice thrift.

If your company has not yet put in a Payroll Savings Plan, start now. It's easy! Just telephone your State Savings Bond Director for the help he is eager to give you. Or write to Savings Bond Division, U. S. Treasury Department, Washington, D. C.

Henry V. Pogorzelski, pictured at work in one of America's great automobile plants, is typical of the thousands of skilled employees in this field who are buying U.S. Savings Bonds regularly. Mr. Pogorzelski uses his company Payroll Savings Plan to make his contribution to the Peace Power of his country.

WATER & SEWAGE WORKS

THE U. S. GOVERNMENT DOES NOT PAY FOR THIS ADVERTISEMENT. THE TREASURY DEPARTMENT THANKS, FOR THEIR PATRIOTISM, THE ADVERTISING COUNCIL AND THE DONOR ABOVE.

News of Suppliers

CONTINUED FROM PAGE 100A

profound effect in the Union of South Africa which has large supplies of brackish water, but limited supplies of fresh water. It also covers many other water-short areas, including India, Australia, Tasmania, Nigeria, Ghana, Ceylon, Kenya, Tanganyika, Uganda, British Somaliland, Pakistan, New Zealand and several other British and former British possessions in Asia and Africa.

Sales Executive Changes at Keasbey & Mattison

Keasbey & Mattison Co., Ambler, Pa., has announced executive changes in its sales division.

D. W. Widmayer, Vice President and member of the Board of Directors, moves from Director of Sales to Marketing Consultant, in which capacity he will be concerned with market development for K&M's expanding line of products.

Norman L. Barr, formerly General Sales Manager of the company's Asbestos-Cement Pipe Division becomes General Sales Manager heading up Keasbey & Mattison's Sales Division.

James R. Reichel will be the new General Sales Manager of the Asbestos-Cement Pipe Division after having served as District Sales Manager of K&M's San Francisco District office. He is succeeded by John L. Prechek, formerly Asst. District Sales Manager.

Krebs Heads Yeomans Pumps Sales

Yeomans Brothers Co., Melrose Park, Illinois, has announced the appointment of J. Robert Krebs as sales manager of the pump division. Formerly a district sales manager of Dean Brothers Pumps of Indianapolis, Krebs is a graduate of Purdue University, having received his B.S. ME in 1950 and M.S. ME in 1951.

In addition to his sales engineering experience, Krebs has done research engineering for Standard Oil Company (Indiana) and instructed in fluid mechanics at Purdue University, Calumet Campus. He is a Registered Professional Engineer, a member of the American Society of Mechanical Engineers, of the Indiana Society of Professional Engineers, and of the honorary fraternities Sigma XI (Scientific Research) and Pi Tau Sigma (Mechanical Engineering.)

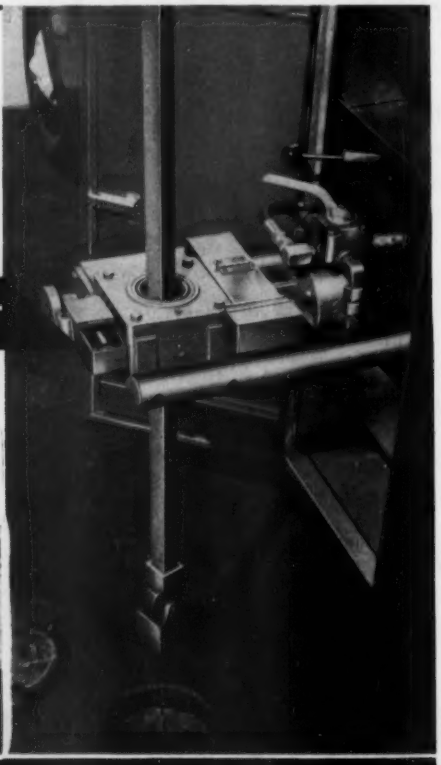
This bid seems to be a dollar or two under yours, gentlemen. So my son-in-law gets the contract!

Truck models operate from truck transmission ... portable units from 3 to 7½ h.p. Save time ... reduce cost ... improve maintenance.

hitch horse sense to horsepower

Make every valve POWER OPERATED...

New fluid drive all-hydraulic, centralized-control, PAYNE DEAN valve operators.



Payne Dean & Company Clinton, Conn.

permanent

CAST IRON PRESSURE PIPE

Lowest in Long Run Cost

FOR WATER AND SEWER MAINS

This section of cast iron pipe laid in Lynchburg, Va., in the late 1820's and uncovered more than a century later in 1936, was still usable. Note that it carried a heavy load of rock as well as street and rail traffic all these years.

When you specify the pipe for water works or sewer main improvements or extensions in your community, consider these facts:

First **— cost of the pipe on your job will be a minor part of the total outlay, regardless of what pipe material you use.**

Second **— differential in the cost of permanent Cast Iron Pipe and non-metallic substitutes will be negligible in relation to the over-all cost of the project.**

Third **— the amortized cost of Cast Iron Pipe over its period of useful, trouble-free service—100 years or more—will be far less than that of any other pipe that you can buy at any price.**

Save money for your taxpayers! Save replacement and repairs! Specify the *only* pipe that's stood the test of time — permanent CAST IRON.

Our Company does not manufacture pipe but has long supplied the nation's leading cast iron pipe producers with quality iron from which quality pipe is made.

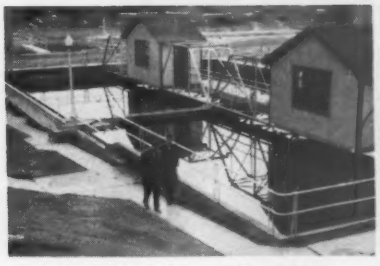
WOODWARD IRON COMPANY

Since 1882

WOODWARD, ALABAMA

Hardinge Center-Column Clarifier recently installed at the Hagerstown Sewage Plant

another HARDINGE Clarifier for HAGERSTOWN



Original installation: Two Hardinge Rotary Clarifier Mechanisms in rectangular tanks.

Second installation: A Hardinge Primary Clarifier doing heavy duty.

- *1932*—The City of Hagerstown, Maryland, installed its first Hardinge equipment in their sewage treatment plant—two 50′ x 12′ rotary mechanisms for final clarification.
- *1949*—The City of Hagerstown, installed a 55′ diameter Hardinge circular beam-type primary clarifier for raw screened sewage in their disposal plant—H. E. Rhodes, Superintendent.
- *1958*—The City of Hagerstown installed the 60′ diameter Hardinge center-column circular clarifier pictured above, for additional final clarification in their activated sludge plant—J. L. Eyerly, Superintendent.
- *Today*—The Hagerstown Sewage Plant is now processing an average of six million gallons of sewage daily with Hardinge units, old and new alike, in full operation.

HARDINGE
COMPANY, INCORPORATED

YORK, PENNSYLVANIA • 240 ARCH ST. • Main Office and Works

New York • Toronto • Chicago • Hibbing • Houston • Salt Lake City • San Francisco • Birmingham • Jacksonville Beach

New Bulletins

AVAILABLE FREE

Clarifier for Sludge Removal

318

Dorr-Oliver, Inc., Stamford, Conn., has released a new four page, two color bulletin entitled, "The Dorr SR Clarifier". This bulletin describes the design features and advantages of this new final unit for continuous, rapid sludge removal. Also included are installation photographs and line drawings of the unit, and a chart of design data.

According to the bulletin, the units were designed to provide continuous, immediate removal of biologically active solids in the final clarification step of the activated sludge process. The Dorr SR Clarifier makes a sharp three-product separation. Special modifications include deflector blades attached to the rake arms slightly above the tank floor and vertical uptake pipes mounted on the rake arm structures and leading upward from the blades to radial collecting troughs at surface level of the tank. These troughs empty into a central circular basin surrounding the mechanism center column.

Self-Priming Centrifugal Pump

319

Worthington Corp., Harrison, N. J., has announced the availability of a specification sheet on its Blue Brute 40M Engine Driven Self Priming Centrifugal Pump, a new size recently added to its 1958 line of Contractors' pumps.

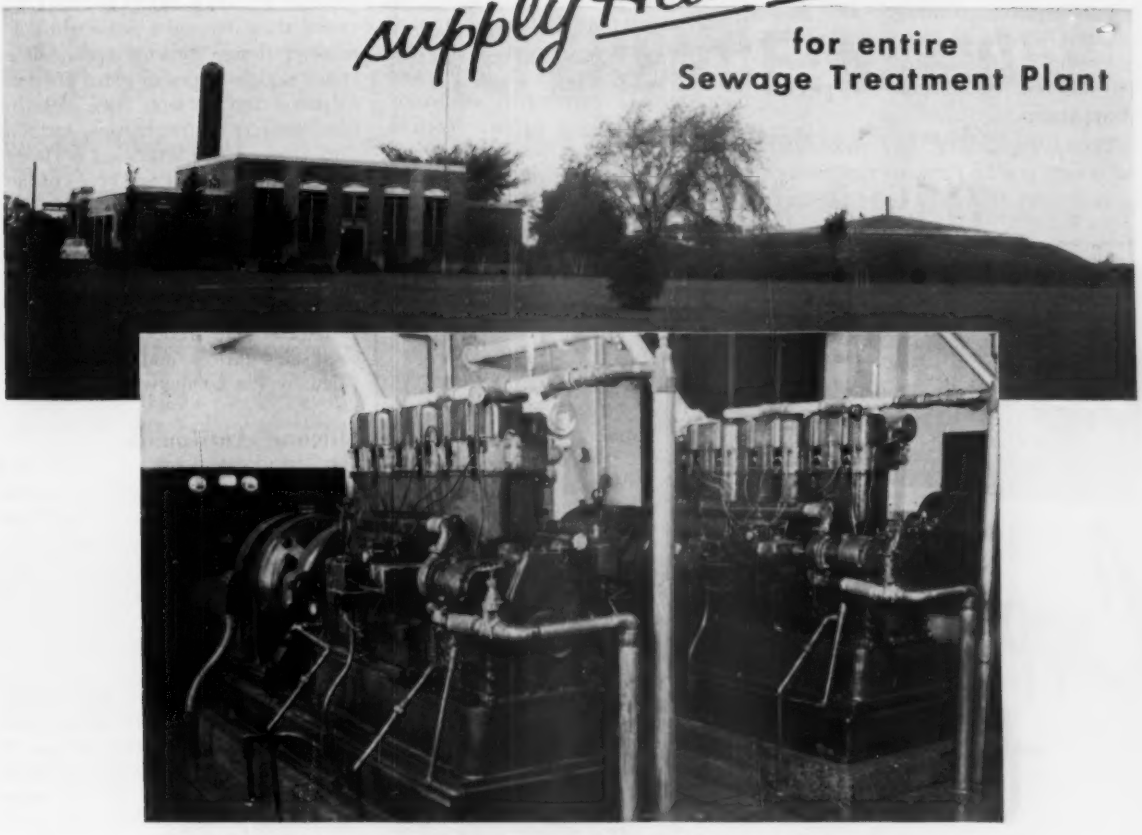
The specification sheet states that new 40M Blue Brute pump is also available as a motor driven unit and features the exclusive Worthington replacement cast iron recirculation port that eliminates valves and permits renewal of internal clearance.

The specification sheet contains complete dimensional and pump and engine data.

CONTINUED ON PAGE 106A

TWO ROILINE ENGINES supply Heat and Power for entire Sewage Treatment Plant

(Formerly LE ROI)



City of Oshkosh, Wis., sewage treatment plant powered by two Model F-1500 Roiline Engines—1503 cu. in. displ., 6¾-in. bore x 7-in. stroke, counterbalanced crankshaft—each 215 max. hp at 1200 rpm

Operating continuously, but alternately . . . one engine working, the other standing by . . . two F-1500 ROILINES, driving 50 KW generators, supply heat and power for this entire sewage treatment plant, including the digestors. It is not unusual for ROILINES in service like this to run 30,000 hours or more without major overhaul.

Not only dependable power but low up-keep and long service life is built into ROILINE Engines. With a close-to-perfection combustion chamber that gives you more horsepower per fuel dollar. With full length guided valve stem mechanisms, light weight cam ground aluminum pistons, precision bearings, full flow oil filters, sectional water-cooled exhaust manifolds, large main bearings, full pressure lubrication, and other big features.

For details, send for Bulletin E-9.

ARIZONA, Casa Grande, Engine Service Company, Inc.
ARKANSAS, Paragould, Wonder State Manufacturing Co.
CALIFORNIA, Long Beach, Engine & Equipment Company
COLORADO, Denver, Emrick & Hill Engine & Equipt. Co.
ILLINOIS, Centralia, John Nickell Company
KANSAS, Garden City, Carson Machine & Supply Co.
LOUISIANA, Shreveport, Ingersoll Corporation
MICHIGAN, Reed City, Hafer Engine Company
OHIO, Columbus 19, Cantwell Machinery Company
OKLAHOMA, Chickasha, Chickasha Gin & Mill Supplies
Oklahoma City 9, Carson Machine & Supply Co.
PENNSYLVANIA, Pittsburgh 34, P. C. McKenzie Company
TEXAS, Houston 1, Southern Engine & Pump Co.
Lubbock, Farmers Supply Company
Odessa, General Machine & Supply Co.
Wichita Falls, Nortex Engine & Equipment Co.
WYOMING, Casper, Emrick & Hill Engine & Equipt. Co.

• *The trade mark LE ROI is used under license from Westinghouse Airbrake Co., the trade mark owner.*

409

WAUKESHA MOTOR COMPANY, WAUKESHA, WISCONSIN / **New York • Tulsa • Los Angeles**
Factories: Waukesha, Wisconsin and Clinton, Iowa

New Bulletins

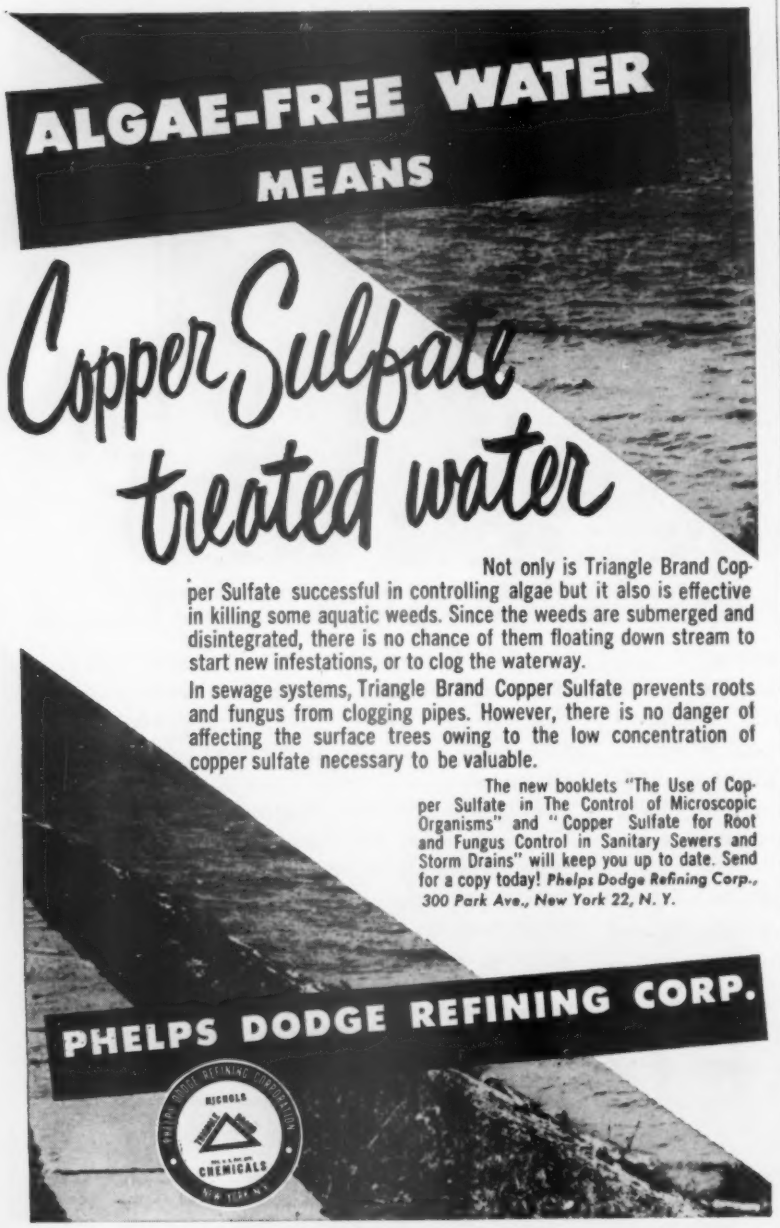
CONTINUED FROM PAGE 104A

Laboratory Equipment

320

Labline, Inc., Chicago, Ill., has available a new, 175-page catalog illustrating and describing more than 450 different instruments and pieces of apparatus.

The 1959 catalog has embossed leatherette covers with multi-ring binders, and illustrates and describes such items as constant temperature baths; drying ovens; environmental units for humidity, altitude and low temperatures; an extensive line of petroleum testing equipment; sectional laboratory furniture; bench and floor model centrifuges; Alumaloy clamps; walk-in ovens; reach-in ovens to 1000°F; incubators; incubating rooms; refrigerated baths; constant temperature cabinets; serological baths, meters; humidity indicators; and other useful apparatus for the laboratory and plant.


ALGAE-FREE WATER
MEANS
Copper Sulfate
treated water
Not only is Triangle Brand Copper Sulfate successful in controlling algae but it also is effective in killing some aquatic weeds. Since the weeds are submerged and disintegrated, there is no chance of them floating down stream to start new infestations, or to clog the waterway.
In sewage systems, Triangle Brand Copper Sulfate prevents roots and fungus from clogging pipes. However, there is no danger of affecting the surface trees owing to the low concentration of copper sulfate necessary to be valuable.
The new booklets "The Use of Copper Sulfate in The Control of Microscopic Organisms" and "Copper Sulfate for Root and Fungus Control in Sanitary Sewers and Storm Drains" will keep you up to date. Send for a copy today! Phelps Dodge Refining Corp., 300 Park Ave., New York 22, N. Y.
PHELPS DODGE REFINING CORP.
NICHOLS
CHEMICALS

Glass Fiber Insulation

321

L. O. F. Glass Fibers Co., Toledo, Ohio, has published a new eight page product design brochure that illustrates various types of glass fiber insulations and presents their description, product features, uses, installation, thermal and acoustical performance, standard items and types of facings available.

Also included are sections on quartz micro-fibers for high temperature insulation, the advantages and uses of glass papers, plus rovings, textile yarns and mat products. Back cover lists sales offices and services provided by the company.

Silicone Antifoams

322

Hodag Chemical Corporation, Chicago, Ill., has available a new brochure with information on Silicone Antifoams. Trial samples of Hodag's Silicone Antifoams are also available at no charge.

The brochure describes the chemical properties of silicone antifoams and outlines the nature of foaming systems. Information on Hodag Silicone Antifoams, including selection of the proper antifoam, specific physical and chemical properties of each type, application, prices, and other similar data is covered in detail.

The brochure also gives information on Hodag's Field Engineering Service and lists a variety of industries and processes in which Hodag silicone antifoams are used as a low cost solution to foam problems. Hodag offers a variety of stock silicone antifoams for most applications, and makes special formulations to meet unusual requirements.

Sewage System Data File

323

Kenco Pump Div., The American Crucible Products Co., Cleveland, O., has just released a new data file on septic tank and sewage applications which presents a complete round-up of underground and above-ground disposal filter systems together with engineering data on Kenco's complete package alternator, the Kenco-Trol, and Kenco's new heavy-duty septic tank pumps, Models 119 and 130.

Incinerator Catalog

324

Joseph Goder, Inc., Chicago, Ill., has available a catalog designed to present complete information on all phases of incinerator selection, installation and operation for every type of refuse destruction. This new illustrated catalog is titled "The Incinerator Blue Book."

Digester Brochure

325

Infilco, Inc., Tucson, Ariz., has just published a 12-page brochure on the anaerobic process in sewage and waste treatment. Replete with diagrams and illustrations, and printed in two colors, it discusses successful methods in the treatment of sewage sludge and other organic wastes by digestion, and describes various types of digesters with a section on suggested specifications.

Concrete For Sewerage Work

326

Portland Cement Association, Chicago, Ill., has available a reprint from their Journal entitled "Concrete for Sewerage Work.

Reference Chart Details Sewer Connections

327

Keasbey & Mattison Company, Ambler, Penna., has announced that plumbers, suppliers, contractors and builders will be aided materially by a new reference wall chart available from the company.

This handy new "how-to-do-it" reference chart shows the most efficient way of connecting asbestos-cement sewer pipe with sewer pipe made from other materials. It is profusely illustrated.

Liquid Level Gages and Valves

328

Jerguson Gage & Valve Co., Burlington, Mass., has just published an 8-page, easy-to-use catalog for the engineer. It illustrates standard and special function gages and valves; gives dimensional drawings, construction features, pressure-temperature graphs and ratings, materials, tables of sizes, specifications and standard and optional features. Illustrated with photographs and drawings.

CONTINUED ON PAGE 108A

See the 1958

WATER & SEWAGE WORKS

REFERENCE NUMBER

For the latest complete information

about WATER SUPPLY

and SEWAGE DISPOSAL

These industry leaders have interesting, informative messages in this great issue:

Ace Pipe Cleaning Co.
Alabama Pipe Co.
Allis-Chalmers
Amercoat Corp.
American Vitrified Products Co.
American Well Works
Anthracite Equipment Corp.
Bailey Meter Company
Beaumont Birch Company
Bethlehem Steel Company
B-I-F Industries, Inc.
Blackburn-Smith Mfg. Co., Inc.
Borden Metal Products Co.
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New Bulletins

CONTINUED FROM PAGE 107A

Products for Sewage Disposal Plants

329

Rockwell Manufacturing Co., Pittsburgh, Pa., has just issued a newly revised 24 page bulletin describing all Rockwell products for sewage disposal plants.

Pump Application Movie

330

Torque-Flow Pump Div., Western Machinery Co., San Francisco, Calif., has available a movie titled "The New Twist in Pumping." This 16 mm movie describes the design and operation of the unique Wemco Torque-Flow Pump.

Digital Telemetering System

331

Control Corporation, Minneapolis, Minn., has available a catalog detailing the TM-16 telemetering system.

Corrosion Controlled Wrought Iron

332

A. M. Byers Co., Pittsburgh, Pa., has just published an 8-page booklet on "4-D Wrought Iron, A New Dimension in Corrosion Control." It discusses in detail Byers latest product development, 4-D wrought iron, which is 25% more corrosion resistant than standard wrought iron.

Flanged Coupling Adapters

333

Smith-Blair, South San Francisco, Calif., has available a series of three coupling adapter bulletins showing eight ways of using these adapters with all types of pipe.

Water Pollution Prevention

334

The Portland Cement Association, Chicago, Ill., has released an attractive 2-color mailer on "Untreated Sewage a community menace."

Laboratory Flowrator Kit

335

Fischer & Porter Co., Hatboro, Pa., has available a specification sheet describing the Laboratory Flowrator Kit.

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Rubber Pipe Fittings

336

Luzerne Rubber Company, Trenton, N. J., has issued a bulletin describing Luzerne Hard Rubber Pipe Fittings and Valves.

Blowers-Exhausters

337

Chicago Blower Corp., Chicago, Ill., has released a new bulletin describing the company's complete line of centrifugal, general ventilation, exhauster and axial airfoil fans, turbo pressure blowers, spin induced draft fans and roof ventilators.

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In-Place Cement Lining of Pipe

338

Centriline Corporation, a subsidiary of Raymond International Inc., New York, N. Y., has available a new catalog describing a process of in-place centrifugal cement lining of pipes from 4 to 144 inches in diameter.

Metal Laboratory Equipment

339

Metalab Equipment Co., Division of Norbute Corp., Hickville, N. Y., has available a new 180 page Catalog that contains complete information on Metalab's expanded line of metal laboratory equipment for all industrial, hospital, educational, and research requirements.

Gratings and Treads

340

Reliance Steel Products Co., McKeesport, Pa., has available a new, two-color, 16-page catalog on open floor grating and stair treads.

Liquid Ion Exchanger

341

Resinous Products Div., Rohm & Haas Co., Philadelphia, Pa., has released a new 17-page booklet of technical notes on Amberlite LA-1, liquid amine anion exchange resin. The nature and properties of this liquid ion exchanger are discussed, followed by details in the handling and operational steps in using this product.

Prefabricated Underground Pumping Stations

342

Zimmer & Francescon, Moline, Ill., has available an 8-page bulletin describing the completely prefabricated Z-F Underground Pumping Station.

Multiple Stage Flow Test Panel

343

Fischer & Porter Co., Hatboro, Pa., has just published a technical bulletin describing the company's Test Panel.

According to the bulletin, the panel consists of a four-stage group of high accuracy, low flow variable-area flowmeters piped together with appropriate valving to give over 600 to 1 range of low indications.

CONTINUED ON PAGE 110A

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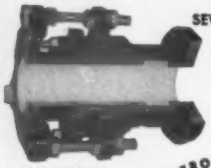

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New Bulletins

CONTINUED FROM PAGE 109A

Communication and Control Systems

344

Femco, Inc., Irwin, Pa., has announced the publication of six illustrated one-page bulletins featuring new Femco control and communication systems.

Rotary Blowers and Pumps

345

Sutorbilt Corp., Compton, Calif., a subsidiary of the Fuller Co., Catasauqua, Pa., has just released a 20-page, 2-color bulletin giving full details on continuous-service rotary positive pressure blowers, gas and vacuum pumps.

Tank and Structure Maintenance

346

Steel and Tank Service Co., Charlotte, N. C., has available a report on Stetsco Service.

The booklet discusses and illustrates the many complete services offered by the company for the care and maintenance of any type of storage tank and most any type of steel structure. Some of the services cov-

Recording Turbidmeter

347

General Electric Co., Schenectady, N. Y., has just published a bulletin describing the General Electric recording turbidmeter which is used to continuously monitor the turbidity or cloudiness of fluids. Applications,

Radial Duafuel Engines

348

Nordberg Mfg. Co., Milwaukee, Wis., has just released a 16-page bulletin describing Nordberg Radial engines, two-cycle Diesel, spark-ignition gas and Duafuel.

Rotameters For Large Pipelines

349

Schutte and Koerting Co., Cornwells Heights, Pa., has just published a new bulletin that describes the company's line of Bypass Rotameters for measuring fluid rate of flow in pipelines 2 inches in diameter and larger.

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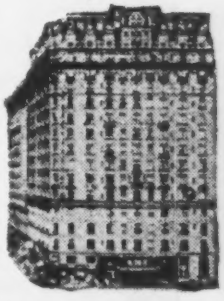

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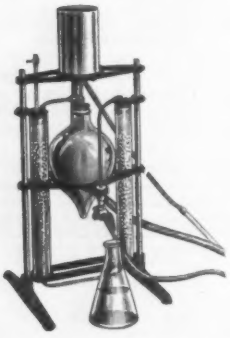

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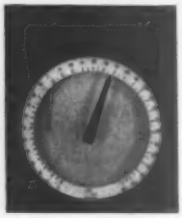

- Recording and Indication when Desired
- Suppressed Head Type
- Any Distance between Transmitter & Receiver

The RTM Roto-Trol operates on the time impulse principle. A tested and proved switching mechanism is operated by a powerful dual motor drive. The motor starters can be controlled direct from the heavy duty mercury switches.

Write for New Bulletin RTM

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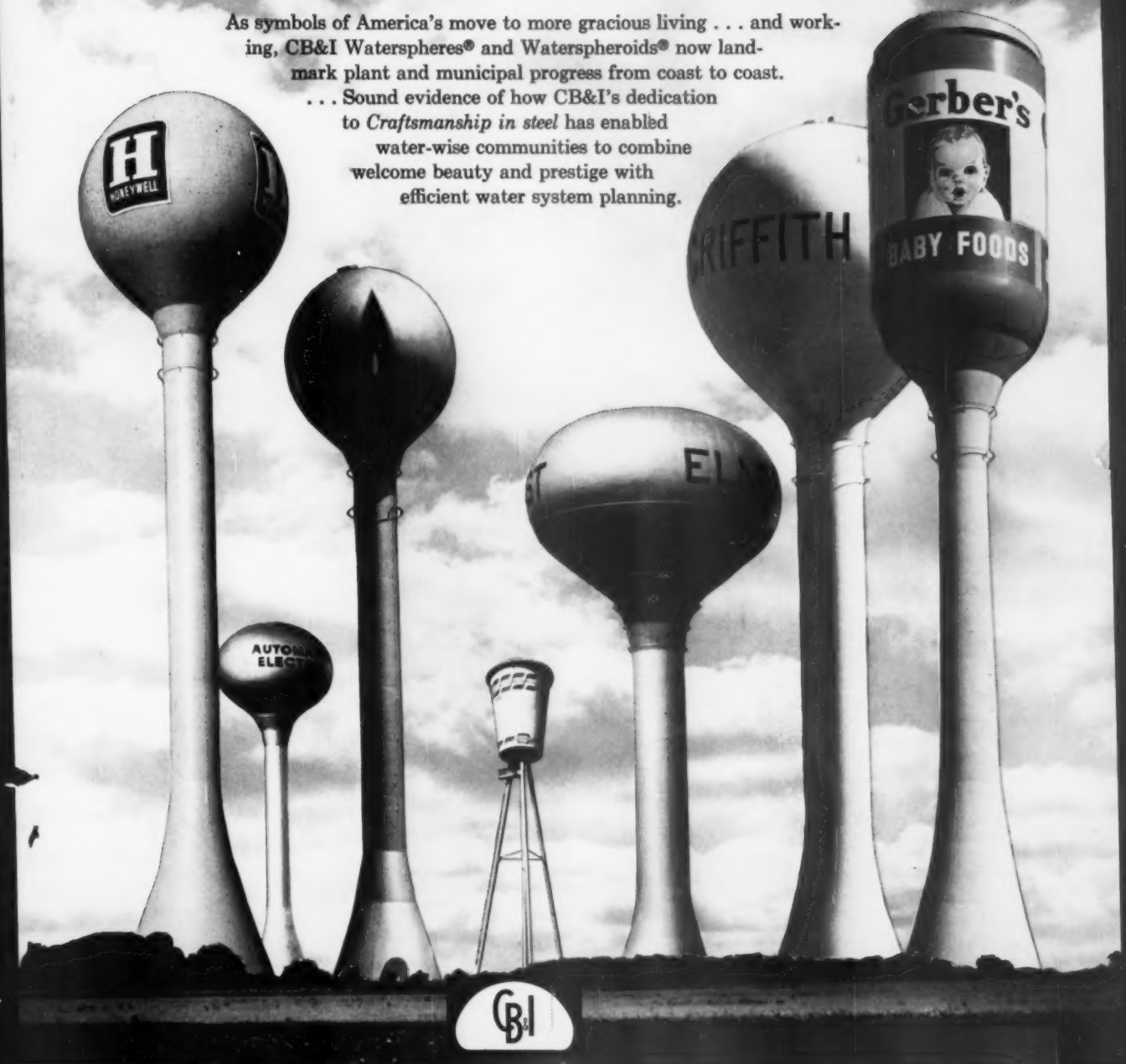

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